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Forest Service

Forest Pest
Management

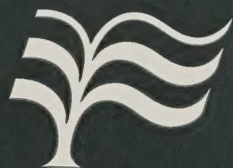
Davis, CA

FIFTH REPORT

National Steering Committee for Management of Gypsy Moth and Eastern Defoliators

FPM 93-2
October 15, 1992

United States
Department of
Agriculture



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Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.



FPM 93-2

October 15, 1992

FIFTH REPORT

NATIONAL STEERING
COMMITTEE FOR
MANAGEMENT OF
GYPSY MOTH AND
EASTERN DEFOLIATORS

Prepared by:

John W. Barry
Chairperson

USDA, Forest Service
Forest Pest Management
2121C Second Street
Davis, CA 95616

FIFTH REPORT

**National Steering Committee for
Management of
Gypsy Moth and Eastern Defoliators**

October 15, 1992

USDA Forest Service
Washington Office/Forest Pest Management
2121 C 2nd Street
Davis, CA 95616
(916) 551-1715

UNIT 1

Department of
Education
State of New York

October 12, 1942

Mr. J. M. ...
Department of ...
State of New York
Albany, New York

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APPENDIX

- A. Committee members' names
- B. List of 24th Annual Conference, 1972 - 1973
- C. Summary of work done during 1972
- D. List of 25th Annual Conference, 1973 - 1974
- E. Summary of work done during 1973

I. INTRODUCTION

The fifth meeting of the National Steering Committee for Management of Gypsy Moth and Eastern Defoliators met at Albuquerque, New Mexico, August 18-19, 1992. The primary purpose of the meeting was to identify national needs for managing eastern defoliators and to report these needs to the Director, Forest Pest Management, USDA Forest Service, Washington, DC.

A. Attendees

Bob Adams	NA/FPM (Radnor, PA)
John Anhold	R-4/FPM (Ogden, UT)
Dayle Bennett	R-3/FPM (Albuquerque, NM)
Bill Buzzard	PA Bureau of Forestry (Middletown, PA)
Dave Bridgwater	R-6/FPM (Portland, OR)
Leo Cadogen	FPMI (Sault Ste. Marie, Ontario)
Jesus Cota	WO/FPM (Washington, DC)
Harold Flake	R-8/FPM (Atlanta, GA)
Tom Hofacker	WO/FPM (Washington, DC)
Win McLane	USDA/APHIS (Otis AFB, MA)
Steve Munson	R-4/FPM (Ogden, UT)
Dave Rising	MTDC (Missoula, MT)
Noel Schneeberger	NA/FPM (Radnor, PA)
Sheri Smith	R-5/FPM (Sonora, CA)
John Wenz	R-5/FPM (Sonora, CA)
Jeff Witcosky	R-8/FPM (Harrisonburg, VA)
Harry O. Yates III	SE/FIDR (Athens, GA)
Jack Barry (Chairperson)	WO/FPM (Davis, CA)

B. Committee Purpose

The purpose of this committee is to identify national needs for managing gypsy moth and defoliators of eastern forests. Management, within the context of the committee, includes direct control with biological and chemical insecticides, cultural control, population monitoring, survey methodology, and risk/hazard rating. The committee identified needs and ranked them in order of priority. A separate category of issues and other needs is included in this report.

The majority of needs identified by this committee are candidates for WO/FPM technology development funding. Other sources of funding should also be pursued as appropriate to address needs identified by this committee to include NAPIAP, unit operating funds, and suppression funds. The call letter for technology development proposals was sent to FPM field offices by Director, Forest Pest Management on September 21, 1992 with responding proposals due by November 16, 1992.

With the expanded scope of the committee, subcommittees will be needed to further evaluate selected issues and develop recommendations. Three subcommittees, listed in paragraph II, C, were appointed at the Blacksburg meeting. Subcommittee member participation is voluntary and subject to concurrence of their supervisors. A letter of instruction that delineates its charge and product delivery schedule will be sent by the Chairperson to each subcommittee.

C. Reports to the Committee

Committee members listed below submitted written reports that are enclosed in the Appendix of this report:

Bob Adams
John Anhold and Steve Munson
Dave Bridgewater
Bill Buzzard
Leo Cadogen
Win McLane
Mike McManus
Dick Reardon
Noel Schneeberger
Harry Yates
Jeff Witcosky

II. CURRENT NATIONAL NEEDS

The technology development needs are listed in order of priority with number one being highest priority. Sub-units within the numerically numbered priorities share equal priority.

A. National Needs

Priority 1

Conduct studies in the West and South on impact of Bacillus thuringiensis (Bt) insecticides on non-target indicator species.

Priority 2

Identify another suitable insecticide to replace DDVP for use in the milk carton control trap. (DDVP is not safe to handle.)

Priority 3

- . Improve methodology for monitoring, detecting, and predicting low and high populations of gypsy moth populations.
- . Develop plan for conducting studies on use of fungus to control gypsy moth. Studies are needed to address questions related to effectiveness, long term results and impact. (This initial effort may require funds for cooperators and/or contractors.)

Priority 4

Evaluate feasibility and/or conduct a pheromone flake study against low populations of gypsy moth in the West.

Priority 5

Conduct field studies to evaluate and possibly ascertain appropriate BIU's of Bt per acre and volume to treatment timing, number of treatments as related to population levels, and forest canopy density. (This obviously is a very complex challenge consisting of several sub-problems.)

- . Validate gypsy moth phenology; model in the West and East.
- . Develop methodology for mass balance and total accountancy of pesticides applied by aerial and ground spray equipment.

Priority 6

Pilot test new Bt formulations in the East and viruses in the West.

B. Issues and Other Needs

Several issues and other needs were identified and discussed as listed.

1. Need to produce adequate supplies of Gypchek.

2. Need to continue microbial research in the West.
3. Need to continue long-term silvicultural management studies and include same in Forest Health Strategic Plan.
4. Need to encourage long-term silvicultural gypsy moth treatments in the East and South.
5. Need to evaluate data base of Bt undiluted formulations (Sandoz, Abbott, and Novo) relative to evaporation and operational use guidelines. (Harold Thistle, MTDC, will do this within scope of the MTDC/FPM Five-Year Plan.)

III. SUBCOMMITTEE REPORTS

A. Pilot Training

Chairperson Bob Adams, FS

Purpose Determine if need to train forest spray pilots is real or perceived. If real, subcommittee shall submit recommendations to the committee at its next meeting.

Report . General flying skills tend to be good but not necessarily those needed to spray forests.

 . Flying is adequately regulated.

 . Specific flying skills weak in navigation with LORAN-C.

 . Need cooperative seminars to inform industry on specific forest spray skills and to communicate forest spray skills to the aerial application industry.

Potential cooperators are:

 NAAA (National Aerial Application Association)
 NEAAA (North East Aerial Application Association)
 MIAAA (Michigan Aerial Application Association)

- . Recommend on-site pilot familiarization and training on coordination of spray pilots and aerial observer pilots. (Note that State of Maine use to dedicate an entire week for spray pilot training on-site before spray project began.)
- . Bob also noted that spray pilots do a better job when they are being observed.

The subcommittee has completed its charge and Bob Adams was asked to submit a written report to conclude this subcommittee.

B. Non-target Impact

Chairperson Dick Reardon, FS

Purpose To identify what is known and what is needed but not known on impact of Bt and Dimilin on non-target lepidoptera, aquatics, birds, and small mammals. Prepare a bibliography and recommendations, and submit these to the committee by the next meeting in 1992.

Activities Subcommittee did not meet formally but progress was made as reported by Dick Reardon. (See Dick's report in Appendix A.)

C. Canopy Characterization

Chairperson Jack Barry, FS

Purpose To coordinate needs and develop plan to acquire data and information on description and quantification of forest canopies for FSCBG model inputs. Report to committee by next meeting in 1992.

Activities Committee members met during the R-4 gypsy moth eradication project and during the National Spray Model Advisory Committee (NSMAC) meeting in June. This subcommittee is now merged with a similar subcommittee under the NSMAC and is chaired by Jeff Witcosky.

D. Aircraft Swath Width (This is a new subcommittee)

Chairperson Harold Flake, FS

Members Bill Buzzard
Bob Adams
Win McLane
Tim Roland

Purpose To evaluate problem of wide range of swath widths that are assigned by different users to same model aircraft, same operating parameters, and same tank mix.

IV. REVIEW OF 1991 NEEDS AND OTHER ACTIVITIES

Wind tunnel atomization studies of Sandoz Thuricide 64LV undiluted were conducted by Professor Norm Akesson for Jeff Witcosky. Data available from Jeff.

- . Work continues by Dave Miller, University of Connecticut, on describing canopy architecture and comparing FSCBG predictions to field data.
- . Drift study conducted in Utah during the 1991 eradication project has been reported. (See Jack Barry for report.)
- . Canopy penetration studies conducted in Utah 1989-90 have been reported. (See Jack Barry or Bruce Grim for report.)
- . The CASPR aircraft productivity model has been evaluated and report published. (See Jack Barry for a copy.)
- . MTDC will address need to evaluate current spray aircraft guidance including global position system (GPS) and make recommendations for operational and/or field evaluation.
- . MTDC will initiate a project to evaluate, modify, and/or develop application equipment for gypsy moth pheromones.
- . MTDC will survey spray block marking technology.
- . MTDC has completed development and field evaluation of a field weather station. (See Harold Thistle, MTDC, for report.)
- . Plan to develop a model or expert system that predicts efficacy of biological sprays as function of drop size, volume, and concentration. (Contact Dan Twardus, Morgantown, WV.)
- . R-4 is continuing study to define elevational (above MSL) limits of gypsy in the West.
- . Need continues for an improved carrier for Gypchek.
- . Need continues for gypsy moth low population eradication strategy for the West and continued research on the application of F1 sterile technique.
- . Questions exist regarding potential impact of gypsy moth fungus on non-targets.
- . Need continues for better trapping design to detect and delimit gypsy moth populations in mountainous terrain where tremendous variations in drainage wind patterns influence male moth dispersal.
- . Need to continue research to improve the consistency of virus results in low density populations of gypsy moth.
- . Briefing paper in Appendix provides status of Asian gypsy moth in the Pacific Northwest.

V. SUMMARY

The National Steering Committee for Management of Gypsy Moth and Eastern Defoliators met at Albuquerque, New Mexico, August 18-19, 1992. The purpose of the meeting was to identify national needs for managing eastern defoliators and to report these needs to the Director, Forest Pest Management. Needs were identified, listed by priority, and submitted to WO for funding considerations on September 2, 1992. These and other needs and issues are provided in this report for management consideration. The status of 1991 needs are reviewed. The next meeting of the committee, hosted by the Southern Region, is tentatively scheduled to be held at New Orleans, Louisiana, on September 14-15, 1993 preceding the Western Defoliator Committee meeting at the same location. The location is subject to WO approval.

APPENDIX A
COMMITTEE MEMBER REPORTS

1. Bob Adams
2. John Anhold & Steve Munson
3. Dave Bridgewater
4. Bill Buzzard
5. Leo Cadogen
6. Win McLane
7. Mike McManus
8. Dick Reardon
9. Noel Schneeberger
10. Harry Yates
11. Jeff Witcosky
12. John Wenz

Bob Adams



United States
Department of
Agriculture

Forest
Service

Northeastern Area
State & Private
Forestry

5 Radnor Corporate Center
100 Matsonford Road
Radnor, PA 19087-4585

Reply To: 3400/5700

Date: July 31, 1992

Subject: Sixth Annual Suppression and Eradication Projects
Review Meeting

Dear Participant:

Enclosed is a copy of the notes from my Aviation Management and Safety Topics presentation that I made at the Meeting. These notes, plus your personal notes and observations, will provide a fairly comprehensive review of Aviation Management and Safety activities that we all have participated in over the past few years. Please contact me if you have any questions or comments.

Everyone in the Gypsy Moth program should take pride in their efforts to make aviation management and safety issues a top priority. In brief, these efforts are paying off! A general observation: in 1990 there were several major accidents with fatalities, in 1991 there was one major accident without a fatality, in 1992 there was none. However, our vigilance and awareness must not rest! Accomplishing work effectively and efficiently to meet management's goals requires constant efforts by everyone to see that rules, policies and procedures are all followed correctly - so that we can reduce the risk in a known hazardous environment. Yep, that's what "SAFETY" is all about!

Sincerely,

ROBERT G. ADAMS, JR.
Area Aviation Officer
Forest Health Protection

Attch 1



Caring for the Land and Serving People

FS-6200-28b(4-88)

A V I A T I O N

M A N A G E M E N T

and

S A F E T Y

* * * T O P I C S * * *

■ A REPORT TO THE STOCKHOLDERS ■

Bob Adams

July 21, 1992

1. Site visits:

DELAWARE

Don Eggen
Bob Adams

Notes: + good communications system
+ cellular telephone backup
+ simple and efficient operation
+ contractor vehicle operators "carded"

MARYLAND

* Anne Arundel County

Rich Olsen
Noel Schneeberger
Bob Adams

Notes: + excellent site
+ simple and efficient operation
+ good coordination with Baltimore-Washington
International Airport approach control

* State

MD Vet's Cemetery

Sally Hughes
Noel S.
Bob A.

Notes: + excellent site
+ smooth operations
+ Nomex, flight helmets, p.p.e.
+ BIFC radios

Frederick

Betsy Handley
Noel S.
Bob Wolfe
Bob A.

Notes: + "weather!"
+ simple, basic operation

Hancock

Dave Cohen
Noel S.
Bob W.
Bob A.

Notes: + excellent site
+ BIFC radios
+ coordination of heliports, storage sites,
water holes - all pre selected
+ Nomex and p.p.e.

WEST VIRGINIA

Winchester

Norman Dean
Noel S.
Bob W.
Bob A.

Notes: + use of a "Command Post" in a trailer
+ organization -
knowledgeable,
busy,
efficient
+ good communications system

PENNSYLVANIA

Pike County

Tom Bast
Noel S.
Bob A.

Notes: + organization smooth, uses a -
"Coordinator" and
"Dispatcher(s)"
+ BIFC radios (first time)
+ contractor developed info package and
checklists for field employees

NEW JERSEY

"Jump" Airport

George Keock
Charlie Thoms
Bob A.

Notes: + agencies working together
+ NJ State Forestry Fire Service employees
+ excellent site
+ noteworthy - use of aerial observers

MICHIGAN

Midland

(all MI sites were visited by:)

Ron Priest
Irene Borak
Bob A.

Notes: + airport site, fixed wing and rotary wing
+ MI Dept of Agr uses a "block advisor"
+ operator had a spill catchment mounted on
bed of his truck

Gladwin

Notes: + airport site

West Branch

Notes: + airport site
+ Nomex and helmets
+ good radio communications

Roscommon

Notes: + MI DNR airport
+ reciprocating and turbine engined aircraft

Houghton Lake

Notes: + airport site
+ a mixture of several types of fixed wing

WISCONSIN

Sturgeon Bay

Steve Krause
Jim Hanson
Bob A.

Notes: + are the same as Sheboygan

Sheboygan

Notes: + airport sites
+ operator uses a "Command Van" and a discrete
company frequency
+ a spill apron is used
+ excellent, brief congested area plans
+ Steve uses an excellent "briefing book"
+ there was good evidence of an effective
"p.r." plan in place.

GENERAL COMMENTS

- + increased awareness is paying off:
 - * fewer accidents and incidents
 - * "bosses" are in the field more frequently and are more familiar with field operations
 - * agency personnel and contractor personnel have a better understanding of each other's needs
- + enhanced communications
- + ENTHUSIASM!
- + GOOD THINGS AT EACH SITE VISITED!

SOME CONCERNS

- + personnel protective equipment (p.p.e.)
 - * requirements vary from state-to-state
 - * requirments should be uniform
 - * if p.p.e. is required in the contract, wear should be enforced
 - + the phenomena of "the shortening hose and shrinking safety circle"
 - + heliport selection - most are excellent, however:
 - * confined space
 - * overhead wires
 - * uphill departures
- continue to be a problem in some areas.
- + Don Eggen's idea for a common "table of contents"
 - + fuels and fuels handling -
 - * placards
 - * no smoking
 - * fire extinguishers
 - * mixed aviation gasoline and jet fuel loads
 - * mixed fuel and pesticide loads

+ fuels and fuels handling (cont'd) -

* needed:

USDOT info from 49 USC - -

your state's info

assistance to operator by identifying sources
of info

+ sharing operational information with adjoining agencies

"KEEP WORKING AT THIS!"

+ aircraft working with new or repaired engines, without a few
flight hours, first!

+ field personnel can observe:

* arguments

* fuel cycles

* health factors

to step in and prevent an accident from occurring!

+ the "herding instinct" as r/w and f/w aircraft park closer
and closer together as the day wears on.

2. Training/Technical Assistance Accomplishments:

Tech' assistance -

Included responses to inquiries, publications and references, and training
such as the "Radio Communications Seminars."

Training -

1990

Contracting Workshop, WV

Basic Aviation Management and Safety (BAMS), PA-5

1991

S-270 Basic Aviation Operations, Morgantown-2

BAMS, MD, VA, WV-2, WI, MI-2, NH

National Pesticide Application Workshop (Marana)

I-220 Basic Incident Command System, Valley Forge

S-270, Valley Forge

Northeast Aviation Management and Safety (NAMS), OH

S-270, VA-2

1992

Radio Communications Seminars, MI, PA-2, MD, VA, WV

Communications Unit Leader, ID, CA

BAMS, MD-2

S-270, MD

Training Needs -

Northeast Aviation Management and Safety, summer 93

Pinch Hitter, summer 93

Aerial Observer, summer 93

Radio Communications Seminar, 2- winter 92-93

Communications Unit Leader in NA, winter 92-93

S-270, S-271 Heliport Manager, S-272 Helispot Manager
- as needed

Managing and Administrating Contracts ("COR"), winter 92-93

3. Aviation Safety Action Plan - priorities for 92 - 93:

- + Aerial Observer Training
- + Pumps, Meters, Hydraulics - Basic Training
- + Contracts (compendium, table of contents, standard spec's)

4. Other Topics:

- + Personal Protective Equipment (p.p.e.)
 - USFS NA continue to assist through state program deducts
- + BIFC FPM program radios
 - USFS NA continue to facilitate use, and training
- + Disseminate GSA and USFS radio contract purchasing requirements

#

A Report to the National Steering Committee
For Management of Gypsy Moth and
Eastern Defoliators

John Anhold & Steve Munson

USDA Forest Service
Forest Pest Management
4746 South 1900 East
Ogden, Utah 84403
(801) 476-9720

The fourth year of the Utah Eradication Project was conducted in 1992 with 15,718 acres sprayed. The success of the 1992 treatment will be determined upon completion of trapping the end of October. Approximately 12,000 traps were deployed this summer which include detection, delimitation, mass, and move-in trapping. Several special projects have been conducted with this years program.

1992 UTAH GYPSY MOTH ERADICATION PROGRAM

TREATMENT - Aerially treated acreage dropped approximately 50 percent from acreage treated in 1991 (29,064 acres). Aerial application of Bacillus thuringiensis, (Bt) was applied over 6 blocks consisting of 15,718 acres within 4 counties in 1992 (Table 1). Each spray block was treated three times at five day intervals. A Hughes 500 and a Bell 206 BIII were used for application. All aircraft were equipped with four electronic rotary atomizer Beecomist nozzles calibrated to deliver 64 oz. per acre. Thuricide 48LV at 24 BIU's was applied neat for all applications. Application costs, which include the cost of the Bt and aerial application was \$9.27 per acre.

Treatment success will be determined once all traps have been retrieved the end of October. Also at that time, the 1993 aerial treatment areas will be discussed.

Surveys for sensitive species of non-target moths and butterflies have been conducted so mitigating measures may be taken if conflicts arise with potential future treatment areas. A lepidoptera release and catch study is being conducted in a previously treated area to determine the effectiveness of reintroduction techniques.

TRAPPING - This years trapping program consists of four trapping arrays; detection, delimitation, mass, and move-in trapping. Total traps deployed for 1992 was approximately 12,000, an increase of 4,000 traps over 1991 (Table 2). Retrieval of traps will begin in September and continue through October. This is the first year mass trapping was used as a treatment option. A 200 acre block was trapped at 9 traps/acre in the Provo area, south of Salt Lake City.

SPECIAL PROJECTS

Environmental Fate of Bacillus thuringiensis Spray Applied in Mountain Terrain:

- Objectives:
- 1) To quantitate off-site movement of Bt as measured by aerosol impaction, deposition samplers, and Gamble oak foliage.
 - 2) To compare FSCBG model predictions of air concentration and deposition to observed data obtained from field samplers.

Detection, Quantification, and Persistence of Bt in Mountain Soil:

- Objectives:
- 1) Determine levels of natural and/or other Bt in soil from sites in Parley's Canyon not previously treated in any year.
 - 2) Determine levels of Bt within the soil from 1992 pre-treatment levels and post-treatment levels 30 days, 6 months and 12 months after treatment.
 - 3) Determine if there is a correlation between Bt soil levels and Bt recovered from deposition on Mylar samplers and air dosage Rotorod samplers.

Penetration and Deposition of Bt Spray in a Maple Canopy:

- Objectives:
- 1) Determine penetration and deposition of Bt at different layers within a maple canopy.

Release and Capture of Gypsy Moth in Mountainous Terrain:

- Objectives:
- 1) Determine percent capture and flying distances of released sterile male moths using various trapping grids within different terrains.
 - 2) Determine the optimum trapping grid system for mountainous terrain.

Release and Capture of Non-target Lepidoptera in Bt Treated Areas:

- Objectives:
- 1) Determine procedures for re-establishing a lepidoptera population displaced by aerial treatment of Bt.

Cooperators for the above projects include:

USDA Forest Service
Utah Dept. of Agriculture
U.S. Army
USDA APHIS
Dr. Wayne Whaley and Robert Kehrer

Table 1. 1992 Spray Block Acreage

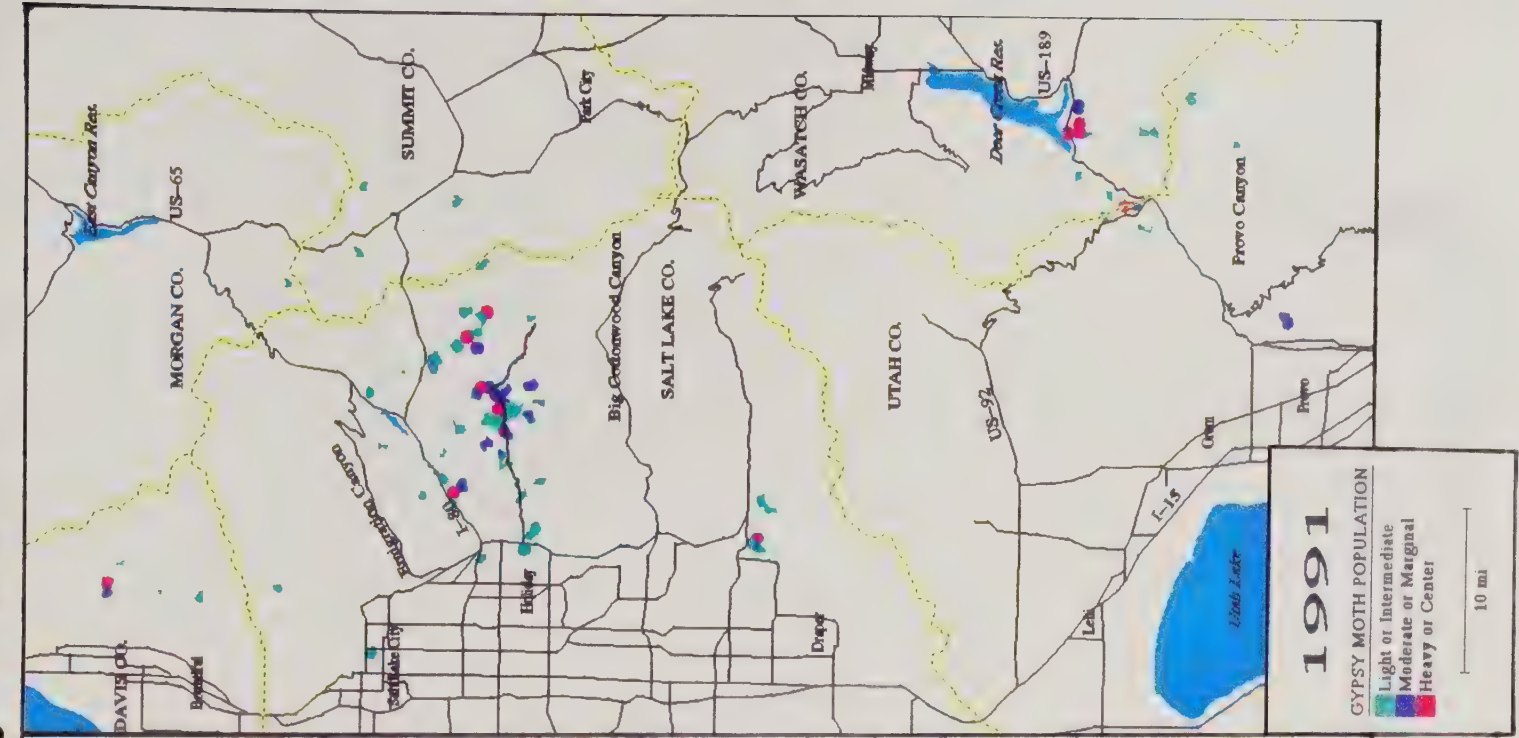
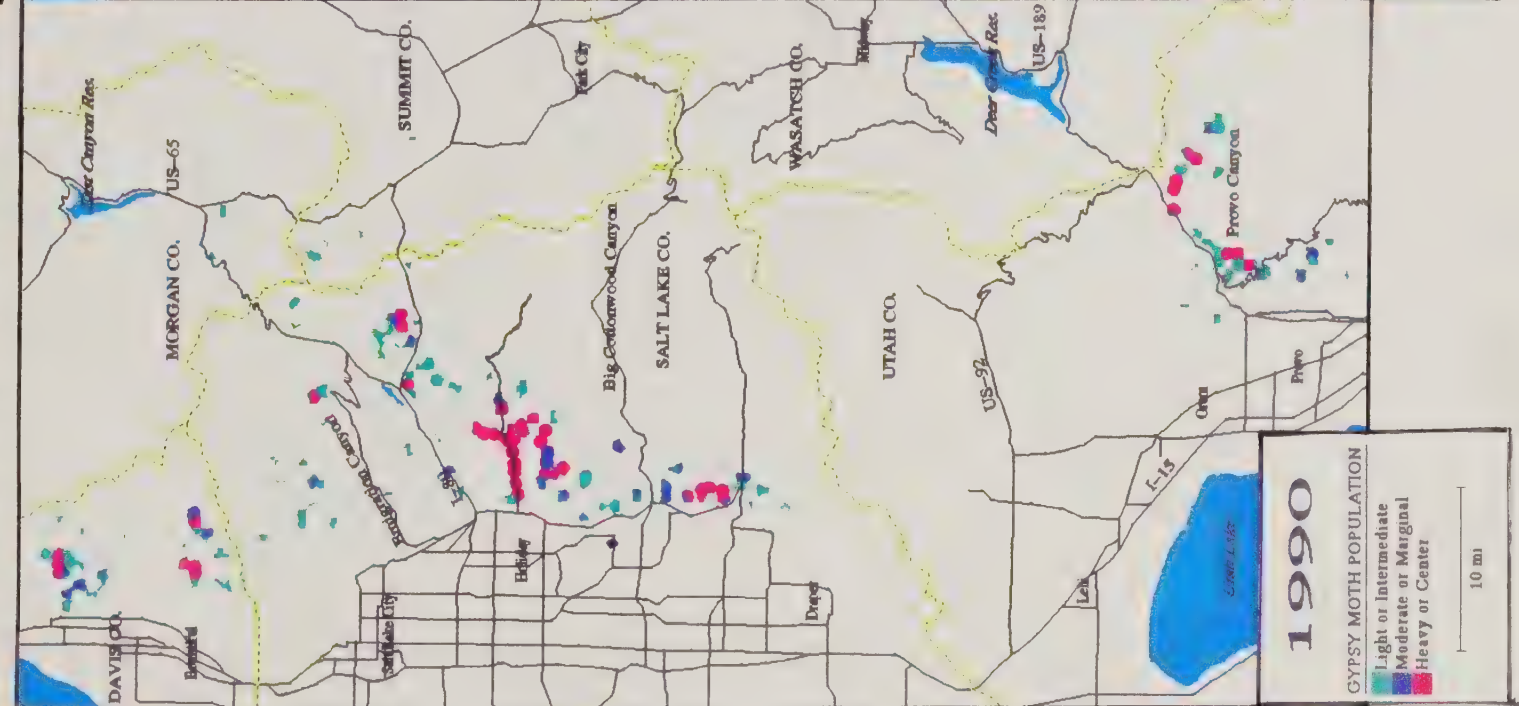
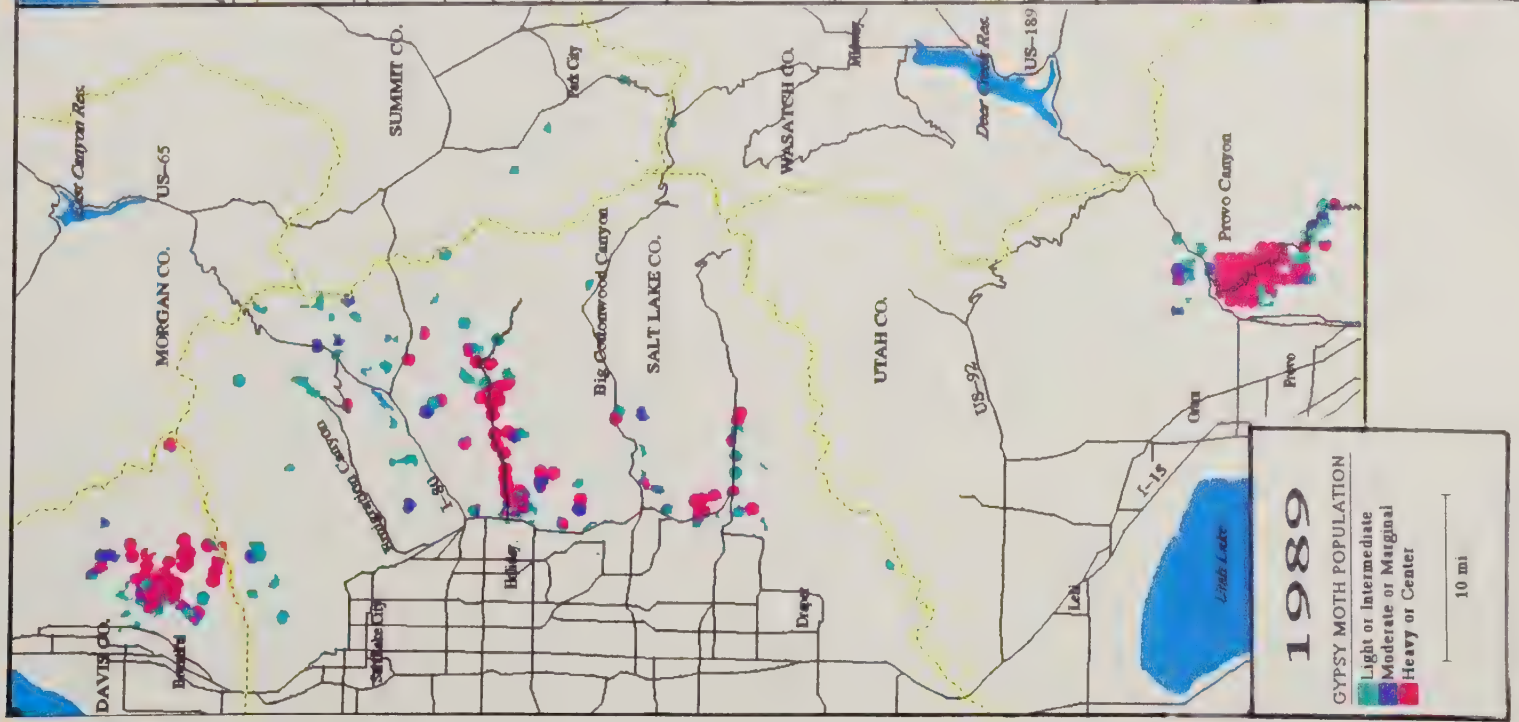
Spray Block	Federal	Non-Federal	Wilderness	Total
DA-1 Ward Creed	493	770		1,263
SL-1 Millcreek	7,379	1,467	1,340	8,846
SL-2 Parleys Canyon	508	555		1,063
SL-3 Bells Canyon	809	451	689	1,260
WA-1 Sunday Canyon	8	1,771		1,779
UT-1 North Fork	202	1,305		1,507
TOTAL ACRES	9,399	6,319	2,029	15,718

Table 2. Trap Arrays and Number Placed in Utah from 1988-1992.

Trap Type	1988	1989	1990	1991	1992*
Urban Delimiting	1550	3100	3100	2330	2000
Mountain Delimiting	237	1228	1990	2492	4500
Detection	-	570	169	800	700
Mass	-	500	2210	2014	3600
Move-In	-	-	-	180	1000
TOTALS	1737	5398	7469	7818	11800

*1992 trapping numbers are an estimate,
will have actual numbers end of October.

Gypsy Moth Distribution By Year



Dave Bridgewater

distance of 20 miles around the treatment areas and around ~~all~~ potential introduction sites.

As of August 7, 32 positive "gypsy moths", have been caught in Oregon, and 400 in Washington. None of the catches were made in areas treated for Asian gypsy moth. While most of these moths have not yet been tested for strain determination, all that have been tested have been European strain.

As a result of the human health concerns raised, APHIS held a meeting ^{on 8/20/97} with State Health representatives, NOAA, States and Federal participants to address these concerns. A report should be forthcoming.

Future eradication efforts will be dependent on trap results and strain determinations.

Bill Buzzard

Commonwealth of Pennsylvania
Department of Environmental Resources
Office of Parks and Forestry
Division of Forest Pest Management
34 Airport Drive
Middletown, PA 17057-5021

1992 GYPSY MOTH SUPPRESSION PROJECT

Spray operations in Pennsylvania had a belated start in 1992 because of an unusually cold spring. Operations began on May 10 and were completed on June 2.

All told during that period, there were only four days during which there was no spraying conducted anywhere in the state. This resulted in 20 spray days to do 204,761 acres, an average of 10,238 acres per day. From the reports received, all of the applications were timed properly and the results look good. Only two major retreatments had to be conducted, 150 acres in Lackawanna County and 55 acres in Fulton County--all private Bt acreage.

A total of 17 spray aircraft (12 helicopter and five fixed winged) were used in the six contracts. A breakdown of these by contract is given below. Of the 204,761 acres, 119,640 acres were sprayed with Bt and the balance, 85,121 acres, was treated with DFB. Two formulations of Bt, Foray 48B and Thuricide 48LV, were used each at 24 BIU or 36 BIU per acre. Likewise, two formulations of DFB were used--Dimilin 4L and Dimilin 25W. The following is a detailed breakdown of the acreage by insecticide formulations and rates:

Bt - Foray 48B, 24 BIU, 64 ounces/acre undiluted (30,507 acres)
36 BIU, 96 ounces/acre undiluted (59,056 acres)
Thuricide 48LV, 24 BIU, 64 ounces/acre undiluted (25,782 acres)
36 BIU, 96 ounces/acre undiluted (4,295 acres)

DFB - Dimilin 4L, .25 ounce AI, 1 gallon/acre diluted (44,843 acres)
.1875 ounce AI, 1 gallon/acre diluted (430 acres)
.125 ounce AI, 1 gallon/acre diluted (470 acres)
Dimilin 25W, .25 ounce AI, 1 gallon/acre diluted (37,943 acres)
.1875 ounce AI, 1 gallon/acre diluted (985 acres)
.125 ounce AI, 1 gallon/acre diluted (450 acres)

Other than the usual landowner complaints, there were few problems. We did have an 80-gallon Dimilin spill on the tarmac at the Clearfield Airport which was immediately cleaned up, and the chief pilot for one of the contractors fell from the back of a nurse truck, broke his wrist, and bruised a few other parts.

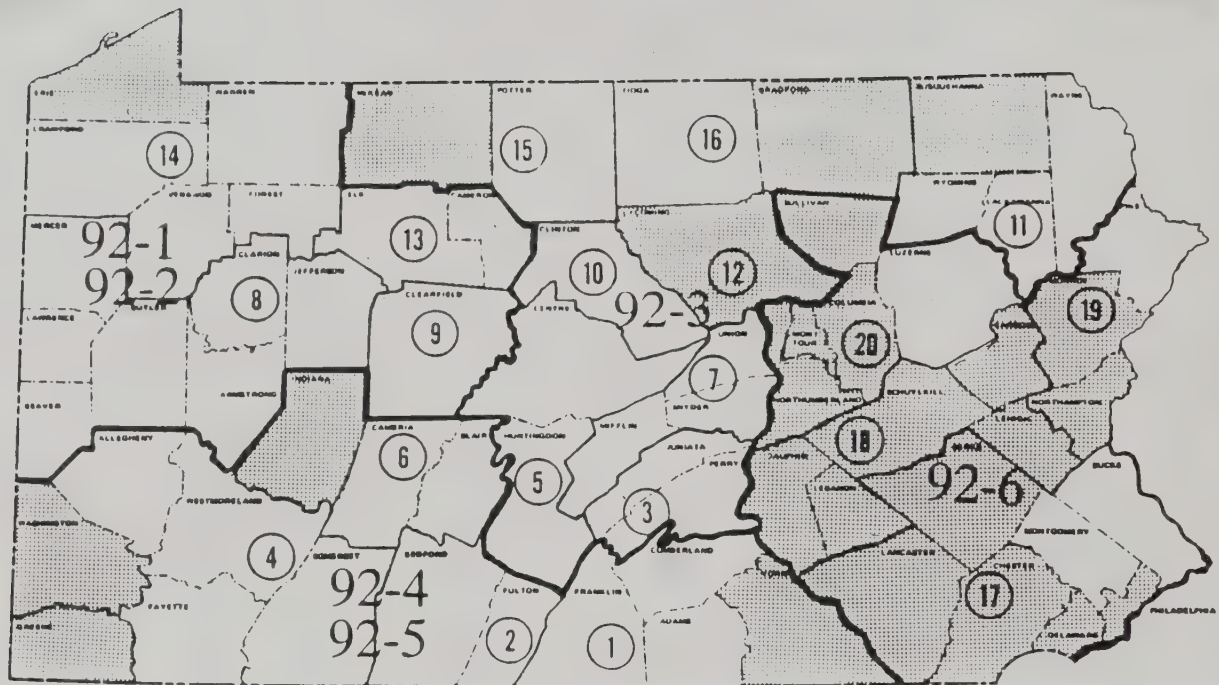
Three special projects were conducted during the course of the 1992 project. The first of these involved low-dosage applications of DFB (0.1875 ounce AI and 0.125 ounce AI) on State Forest land in Clearfield and Centre Counties. Initial observations indicate that even the lowest dosage is working as far as foliage protection is concerned.

The second project was designed to evaluate the use of alternative navigational aids by the spray pilot. Certain residential blocks in Centre County were treated using the standard combination of topographic maps with helium-filled balloons marking reference points on the ground while others were treated using the maps without the balloons. The same pilot and aircraft were used to treat additional residential blocks in Tioga County but with aerial photographs with and without balloons. Comparisons will be made of the time involved and the accuracy of the treatments to determine which method is most efficient and cost effective.

The third project investigated the utility of using radio frequencies separate from the Bureau of Forestry system for communication within a contract area. A series of frequencies and several radio repeaters were borrowed from the USDA Forest Service fire cache system in Boise, Idaho, and utilized while spraying in Pike County. Communications were greatly improved with the system, eliminating the extraneous transmissions which originate within the Bureau of Forestry system and with users in neighboring states who share the Bureau of Forestry frequencies.

The two associated tables provide a breakdown of the acreage treated by ownership and insecticide and the costs incurred for each contract for insecticide and application. A detailed report on the entire project will be available upon request by the end of August.

Contract Areas



① FOREST DISTRICT NUMBER

▨ COUNTIES NOT INVOLVED

Spray Aircraft Used

Contract 92-1

2 - Bell 204
1 - Bell Soloy
1 - Hughes 500D

Contract 92-4

2 - Bell 206

Contract 92-2

3 - Turbo Thrush

Contract 92-5

1 - Air Tractor AT-401
1 - Thrush 600 S2R

Contract 92-3

1 - Bell 206
1 - Bell Soloy
1 - Hughes 500D

Contract 92-6

2 - Bell 204
1 - Bell 206

Acres Treated by Ownership and Insecticide

Ownership	Bt		DFB		Total	
	Acres	Blocks	Acres	Blocks	Acres	Blocks
Private	91,074	1,534	45	2	91,119	1,536
State Forest	16,814	39	81,505	143	98,319	182
State Park	7,896	59	3,203	16	11,099	75
Federal	967	21	0	0	967	21
Other	2,889	22	368	4	3,257	26
Totals	119,640	1,675	85,121	165	204,761	1,840

DER Contract Costs - 1992 Gypsy Moth Suppression Project

Contractor	Contract	Bid Price		Acres Treated		Extra*		Actual Cost/Acre		Contract Cost		
		Bt	DFB	Bt	DFB	Bt	DFB	Bt	DFB	Bt	DFB	Total
AgRotors, Inc. Gettysburg, PA	92-1	\$ 9.42 (24 BIU)	-	60,550	-	317	-	\$10.77 (9.47-24)	-	\$ 651,868.94 (288,949.08-24)	-	\$ 651,868.94
		12.02 (36 BIU)		(30,507-24)		(167-24)		(12.08-36)		(362,919.86-36)		
Aero Tech, Inc. Clovis, NM	92-2	-	\$3.82	-	39,376	-	3	-	\$3.82	-	\$150,435.42	150,435.42
AgRotors, Inc.	92-3	10.32 (24 BIU)	6.75	10,789	18,961	154	0	10.47	6.75	112,931.76	127,986.75	240,918.51
AgRotors, Inc.	92-4	10.32 (24 BIU)	-	19,288	-	143	-	11.01	-	212,370.12	-	212,370.12
		13.02 (36 BIU)		(14,993-24)		(52-24)		(10.36-24)		(155,264.40-24)		
Tallman Aerial Spraying Dauphin, PA	92-5	-	5.03	-	26,782	-	10	-	5.03	-	134,763.76	134,763.76
AgRotors, Inc.	92-6	12.16 (36 BIU)	-	29,013	-	1	-	12.16	-	352,810.24	-	352,810.24
Totals/Averages	All	\$11.06 (9.83-24)	\$4.85	119,640	85,121	615	13	\$11.12 (9.90-24)	\$4.85	\$1,329,981.00 (557,145.24-24)	\$413,185.93	\$1,743,166.99
		(12.15-36)		(56,289-24)		(373-24)		(12.20-36)		(772,835.82-36)		

Total Acres Treated - 204,761

Average Cost/Acre - \$8.51

*Resprays and calibration adjustments--expressed as acre equivalents.

Leo Cadogen

Report to National Steering Committee For Management Of Gypsy
Moth and Eastern Defoliators

Albuquerque, New Mexico, Aug 18-19 1992

Compiled by B.L. Cadogan

Forestry Canada - FPMI
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The following are summaries of research relevant to the control of Eastern defoliators that was conducted at FPMI during 1991 - 1992.

Inquiries should be directed to the relevant principle researcher.

Principle Researchers: John Cunningham and K.W. Brown - Gypsy moth virus spray trials in Ontario

Several virus treatments were applied on gypsy moth larvae in Simcoe and Aylmer districts in Ontario in 1992 in cooperation with the USDA Forest Service, Ontario Ministry of Natural Resources and American Cyanamid Company. Development of both trees and gypsy moth larvae was late this year and the summer was generally wet and cool. Gypsy moth populations across Ontario were lower and the area of moderate-to-severe defoliation was about one tenth of what it was in 1991. All virus applications in 1992 were double applications 3 to 4 days apart. Larvae were mainly in their first instar at the time of the first application and were in their second instars at the time of the second application. The emitted volume on all applications was 5.0 L/ha. The treatments were as follows:

1. A pilot test with Gypcheck was conducted in collaboration with the USDA Forest Service. Virus dosage was a double application of 5×10^{11} PIB/ha giving a total of 10^{12} PIB/ha. The tank mix contained 25% v/v molasses, 6% Orzan L.S. and 2% v/v Rhoplex B60A or Bond sticker. Three plots were treated with a total area of 176.8 ha.
2. A test of Novo aqueous flowable virus carrier with Gypcheck was conducted in collaboration with the USDA Forest Service. Dosage was the same as treatment #1. Three plots with a total area of 38.7 ha were treated.
3. Four plots with a total area of 47.9 ha were treated with Disparvirus produced at FPMI using the same dosage and tank mix as in treatment #1.
4. Four plots with a total area of 43.2 ha were treated with an American Cyanamid wettable powder formulation using the same dosage as in treatment #1.
5. Five plots with a total area of 48.0 ha were treated with an American Cyanamid wettable powder formulation plus an enhancer at one tenth the dosage in treatments #1, #2, #3 and #4, namely a double application of 5×10^{10} PIB/ha giving a total of 10^{11} PIB/ha.
6. Four untreated check plots with a total area of 62 ha.

All plots contained a minimum oak (red and white) component of 30%. Pre-spray egg mass numbers ranged from 1,310 to 7,925/ha. Sprays were applied using two Cessna Agtrucks equipped with 4 AU4000 Micronair units adjusted to rotate at 5,000 r.p.m. Data analysis is incomplete and fall egg mass counts will be conducted in late October. However, defoliation in the check plots was light and ranged from 24 to 44% (mean 30.6%). Less defoliation was recorded on treated plots, but only marginally so. Pupal counts under burlap traps were lower than in previous years and the prognosis is that fall egg mass counts will also be lower than in previous years.

Principle Researcher: David Tyrrell - Fungal pathogens of insects

Progress: *Entomophaga maimaiga* was found for the third consecutive year on gypsy moth larvae collected from the Kingston-Belleville area in eastern Ontario. Axenic cultures of the fungus were obtained from individual infected insects and have been added to our collection. Samples have been sent to Dr. Julie Silver's laboratory at Scarborough College in Toronto for DNA testing against other North American isolates of the same fungus.

Collaboration has been started with Dale Belme, a graduate student in Dr. Bill Cade's lab at Brock University, on the monitoring of natural occurrence and the artificial introduction of the fungus into gypsy moth populations in the Hamilton area. A seminar on my *Entomophaga* research was presented at Brock University last November.

In collaboration with Ross Milne, significant progress has been made on the detection and identification of a cell lytic factor which is believed to be the substance produced by *E. aulicae* in response to photoperiod stimulus and which is directly responsible for causing death of the host insect larva.

Principle Researcher: K.M.S. Sundaram - Spray distribution, deposition and persistence of Bacillus thuringiensis kurstaki [B.t.(k)] in hardwood forests in Virginia and Pennsylvania, USA during the 1992 Gypsy Moth spray program.

The distribution, deposition, persistence and biological activity of spray deposits resulting from aerial applications using helicopter and fixed-wing aircraft were examined in mixed hardwood forests of Virginia and Pennsylvania, USA using undiluted commercial preparations of Bacillus thuringiensis var. kurstaki [B.t.(k)].

In the first study, five blocks in Virginia were sprayed with foray 48B (novo Biocontrol, Danbury, CT) when the gypsy moth larvae were at the 2nd instar stage, using a Bell helicopter fitted with AU7000 rotary atomizers. Spray droplets were collected on water-sensitive cards placed at ground and canopy levels to determine directly the spread-factor values for the droplets. Natural foliage was collected at mid-crown level up to 96 h postspray to measure the reduction of the efficacy of B.t.(k) with time.

The droplet density (droplets/cm²), size spectra (NMD and VMD) and percent deposition vs meteorological factors that existed, application methods (helicopters vs fixed-wing aircraft) and atomizers used and formulation types applied are being critically analyzed. Similarly, the variation in initial foliar deposits (expressed in IU/cm² of target surface) in terms of the above variables will be studied and documented. The differences observed in total B.t.(k) activity due to spores and crystals, persistence characteristics of the toxin, its DT₅₀ etc., with the variables will be examined and accounted.

All facets of the research conducted in this field study including the effectiveness of treatment (2nd instar vs 4th instar) and the impact, if any, on nontarget fauna, will be published in due course along with the USDA cooperators.

Principle Researcher: Dave Kreutzweiser - Effects of BT(k) on the aquatic invertebrate community of a forest stream.

A forest stream was treated with Dipel 64AF in June 1992 at a rate to produce a concentration in stream water of 200 IU/mL. Invertebrate drift, and benthos abundance and composition were monitored in treated and upstream reference sections of the stream. Field sampling is in progress. No results available at time of writing.

Principle Researchers: David Kreutzweiser, Stephen Holmes (FPML, David Behmer (LSSU) - Effects of BT(k) on aquatic microbial respiration and detrital decomposition in laboratory bioassays.

Experiments are being conducted to determine changes in microbial respiration and decomposition activity of aquatic microbial communities on organic material in response to Bt(k) contamination. Dipel 64AF is applied directly to replicate aquatic respiration chambers, and the microbial response compared to that in concurrent reference chambers. Initial experiments are conducted at 1000 X the EEC in 15 cm of water (20,000 IU/mL), subsequent experiments at lower concentrations to determine a no-effect level. Experiments are in progress.

Principle Researchers: David Kreutzweiser, Stephen Holmes - Environmental impact of a molt-accelerating insecticide RH5992 in lake enclosures.

Replicate lake enclosures (5m x 5m x 3m deep) were treated with RH5992-2F in June 1992 at concentrations ranging from 0.05 to 0.5 mg/L. Zooplankton population are being assessed and compared to replicate control enclosures. Field sampling is still in progress.

Principle Researchers: Janet Addison, Stephen Holmes - Effects of Bt(k) on forest soil microcosms.

The effects of Bt(k) (Dipel 64Af and Dipel 176) on the earthworm *Dendrobaena octaedra* and the collembolan *Folsomia candida* are being determined in replicate soil microcosms containing natural forest soil and litter. The Dipel is applied directly to the microcosms at 1000 X the maximum field dose. Effects on survival, reproduction, and growth are determined. Experiments have just been completed and results are being analyzed.

Principle Researchers: K.N Barber, W.J. Kaupp, S.B. Holmes - Non-host specificity testing for nuclear polyhedrosis viruses of gypsy moth and eastern spruce budworm.

Approximately 40 species of non-host species of caterpillars representing 9 families of Lepidoptera have been assayed with *Lymantria dispar* NPV (LdNPV) and determined to be non-permissive. Likewise, about 7 species representing 2 families of Lepidoptera have been assayed with *Choristoneura fumiferana* NPV (CfNPV) and determined to be non-permissive. In addition, adult males of the alfalfa leafcutter bee, *Megachile rotundata* (Fabr.)(Hymenoptera:Megachilidae) have also been determined to be non-permissive for both LdNPV and CfNPV.

Principle Researchers: Leo Cadogan, Ed Kettela and Art Retnakaran - Field Efficacy investigations of RH5992 (Mimic 2F) against spruce budworm.

In the summer of 1992 experimental field trials (pilot tests) were conducted in northern Ontario and New Brunswick to determine the efficacy of RH5992 (Rohm & Hass) against spruce budworm *Choristoneura fumiferana*. The product was mixed in water and sprayed as single application at 17.5g AI, 35g AI and 70g AI per ha. A double application was also made at 35g AI per ha. All dosages were dosages were applied at 2.0l/ha.

At time of writing no results were available.

For the purpose of this study, the following data was collected from the various sources available to the researcher.

The data was collected from the following sources:

Source	Method
Interviews	Open-ended
Surveys	Structured
Documents	Content analysis
Observations	Participant

The data was collected from the following sources:

Interviews: The researcher conducted 10 semi-structured interviews with participants who were selected through purposive sampling. The interviews were conducted in a private setting and lasted approximately 45 minutes each. The data was collected from the following sources:

Surveys: The researcher distributed 50 surveys to participants who were selected through purposive sampling. The surveys were distributed in a private setting and lasted approximately 10 minutes each. The data was collected from the following sources:

Documents: The researcher collected 10 documents from participants who were selected through purposive sampling. The documents were collected in a private setting and lasted approximately 10 minutes each. The data was collected from the following sources:

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Report of APHIS Laboratory and Field
Methods Development Activities

Win McLane

USDA, APHIS, PPQ
Otis Methods Development Center
Building 1398
Otis ANGB, MA 02542-5008

Laboratory tests were conducted at the Otis Quarantine facility to determine how efficacious *Bacillus thuringiensis* is when used against Asian gypsy moth. Asian gypsy moth larvae (2nd instar) were exposed to Foray 48B in diet and on tender oak seedling foliage. The diet section of these studies was a cooperative project with Forest Service, Hamden, Connecticut.

Preliminary comparison of the introduced Asian source of gypsy moth with the two North American sources against *Bacillus thuringiensis*

		Cumulative Percent Mortality (SD)		
<u>Larval Source</u>	<u>Dose (μg/ml)</u>	<u>Day 5</u>	<u>Day 10</u>	<u>Day 14</u>
Hamden	6.25	19.3 (3.06)	39.3 (11.37)	67.3 (11.37)
	3.125	6.0 (2.00)	20.8 (6.16)	37.8 (6.01)
	1.56	2.0 (2.00)	4.03 (0.06)	11.5 (5.89)
	0.79	0.0	0.7	1.4 (1.21)
	Control	0.0	0.0	0.0
<u>Larval Source</u>	<u>Dose (μg/ml)</u>	<u>Day 5</u>	<u>Day 10</u>	<u>Day 14</u>
Otis	6.25	4.0 (2.00)	18.0 (5.29)	49.3 (8.33)
	3.125	0.0	1.3 (1.15)	47.6 (30.47)
	1.56	0.0	0.67	7.0 (1.18)
	0.79	0.0	2.7 (3.06)	4.0 (3.49)
	Control	6.0	6.0	22.4
<u>Larval Source</u>	<u>Dose (μg/ml)</u>	<u>Day 5</u>	<u>Day 10</u>	<u>Day 14</u>
Asia	6.25	12.7 (5.77)	66.9 (24.55)	93.9 (5.4)
	3.125	4.7 (5.03)	30.8 (6.79)	45.1 (19.63)
	1.56	2.7 (1.15)	7.3 (7.57)	22.7 (9.45)
	0.79	0.67	1.3	4.07 (2.00)
	Control	2.0	10.4	12.5

Methods: Second instar larvae were used; diet was replaced every 3 days with fresh dosed diet; incubation conditions were 22°C, 16:8 L:D photoperiod, RH was 45-50%. Means of 3 replicates. One replicate was used for controls. The HD-1-S-1980 *Bacillus thuringiensis* standard was used.

Conclusions: Preliminary analysis suggests that the introduced "Asian Gypsy Moth" is as or may be more susceptible to *Bt* than two North American sources that are maintained at two different laboratories in the U.S.

Tender Northern red oak seedlings approximately 8 inches in height were sprayed with 2 dosages of Foray 48B undiluted. Each treatment was replicated 10 times. Following a 4 hour drying time, 20 newly moulted 2nd instars, laboratory reared, gypsy moth larvae of each strain were placed on treated seedlings. Plants and test insects were held in the Otis Methods Development quarantine laboratory. Chamber temperature was 78°F with 45% RH.

Larval mortality and seedling defoliation was recorded each day during the test. Criteria for mortality was no movement when probed with a fine brush.

Asian gypsy moth were found to be as susceptible to Foray 48B as the North American strain. The North American strain was more susceptible early in the test, however, after 6 days, mortality was equal.

Table 1. Percent larval mortality and seedling defoliation following exposure of AGM and NAGM to oak seedlings treated with Foray 48B.

Dosage BIU/Acre	Gypsy Moth Strain	Percent Mortality				Percent Defoliation		
		1 D ^{1/}	2 D	4 D	6 D	1 D	3 D	5 D
24 - 64 oz.	NAGM	27	69	98	100	1	2	2
16 - 43 oz.	NAGM	31	62	92	99	2	2	2
Control	NAGM	0	0	1	1	48	90	100
24 - 64 oz.	AGM	6	68	94	99	2	2	2
16 - 43 oz.	AGM	5	46	82	99	2	3	4
Control	AGM	0	0	0	0	57	79	100

^{1/}Days larvae exposed to treated foliage.

A very limited test was also conducted with Dimilin. Asian gypsy moth were found to be very susceptible to Dimilin when exposed to treated oak foliage.

The testing of Asian gypsy moth was limited because of the lack of viable egg masses.

Steward WG, a *Bacillus thuringiensis* (Bt) formulation, was tested against newly moulted 2nd instar, laboratory reared, gypsy moth larvae. Steward WG is formulated by Sandoz for use by pest control operators and agronomist. Applications would normally be made with mist blowers or hydraulic sprayers using high gallonage per acre.

Steward WG was mixed with water and sprayed onto tender red oak seedlings in a laboratory spray chamber. Three flowable Bt formulations were used as standards. Each treatment was replicated five times with 20 larvae per plant. Two dosages were used, 14.4 and 7.2 BIU/20 gallons/acre. A high rate of total volume was used to simulate mist blower applications. Treated seedlings were

dried for two hours before being exposed to test insects. Seedlings with larvae were held in an environmental chamber at 78°F with 45°RH. Larval mortality and seedling defoliation were recorded over a period of time. Criterion for larval mortality was no movement when probed with a small brush.

Table 2. Larval mortality and seedling defoliation following exposure of *Bt* treated oak seedlings to newly moulted, 2nd instar gypsy moth larvae.

Material	BIU PER 20 gal/acre	Percent Mortality			Percent Defoliation		
		2 Day ^{1/}	4 Day	6 Day	2 Day	4 Day	6 Day
Steward WG	14.4	13	80	98	2	2	2
Steward WG	7.2	1	41	99	5	10	14
Dipel 6AF	14.4	7	43	99	4	11	11
Dipel 6AF	7.2	3	36	99	4	10	10
Foray 48B	14.4	8	27	98	6	12	24
Foray 48B	7.2	4	6	73	11	27	38
Thuricide 48LV	14.4	6	23	92	10	28	32
Thuricide 48LV	7.2	3	13	96	13	27	32
Control	--	0	0	0	63	100	--

^{1/}Days of exposure to treated plants.

Other oak seedlings treated with Steward WG and Thuricide 48LV were exposed to rainfall. Plants were completely dipped into the *Bt* solution, dried for four hours and then exposed to rainfall. Rain was applied to treated plants from a spray boom mounted 30 inches above the foliage. Four rain-drop (Delevan) nozzles were used. After rain, plants were dried in front of a fan and then bioassayed using newly moulted 2nd instar, laboratory reared, gypsy moth larvae.

Table 3. Larval mortality and seedling defoliation following exposure of 2nd instar gypsy moth larvae to treated oak seedlings.

Material	BIU PER 20 gal/507	Inches Rain	Sticker	Percent Mortality			Percent Defoliation		
				2 Day ^{1/}	4 Day	6 Day	1 Day	3 Day	5 Day
Steward WG	14.4	0	--	19	70	99	2	3	3
Steward WG	14.4	0.1	--	21	70	99	2	3	9
Steward WG	14.4	0.25	--	18	53	99	2	5	8
Steward WG	14.4	0.25	2% Bond	21	81	100	2	4	5
Thuricide 48LV	14.4	0	--	13	55	100	2	6	11
Thuricide 48LV	14.4	0.1	--	38	79	99	2	5	5
Thuricide 48LV	14.4	0.25	--	15	44	98	4	10	25
Thuricide 48LV	14.4	0.25	2% Bond	20	44	85	3	7	29
Control	--	--	--	0	0	0	36	100	
Control	--	0.25	--	0	0	0	42	100	

^{1/}Days of exposure to treated plants.

Conclusion

When sprayed on the upper side of red oak foliage in a laboratory spray chamber, Steward WG was as efficacious as all other *Bt* formulations tested. Both dosages tested were equally as effective after a 6 day exposure. Steward WG demonstrated faster kill than other *Bt* formulation tested. Seedling defoliation was less with Steward WG.

Oak foliage dipped in *Bt* solutions gave good kill after a 6 day exposure of test insects. Steward WG was as effective as Thuricide 48LV. The addition of Bond sticker slightly enhanced the early activity of Steward WG, but had no effect on the 6 day exposure reading. Good resistance to rainfall was most likely due to the thorough coverage applied to the under sides of the leaves using the dip application technique. This application technique would closely simulate an actual mist blower treatment.

Steward WG, as do other *Bt* formulations, will settle out if light agitation is not maintained. Steward WG did appear to settle more rapidly than others *Bt* formulations tested.

Based on these data, Steward WG is a *Bt* formulation as effective against newly moulted 2nd instar gypsy moth larvae as any of the most commonly used *Bt* formulations on the market.

During the past three years, the testing of gypsy moth pheromone formulations for mating disruption application have been conducted in Virginia and West Virginia. The standard Hercon flake formulation is applied with special equipment that often causes problems through break-down and/or poor distribution of flakes. Because of these operational problems, emphasis has been directed to the development of a formulation that can be sprayed using conventional aircraft spray systems. Such a formulation has been developed by AgriSense.

The AgriSense beads containing pheromone are mixed in carrier and sprayed through CP nozzles at one gallon per acre. Its important to keep all beads in good suspension and maintain the material throughout the forest canopy. Wash-off and bead suspension have been the major problems with the new material. During 1992, a great deal of time was devoted to formulation improvement. I would like to thank Nalco Chemical Company for their commitment to improving the AgriSense bead formulation.

Field tests were conducted with an experimental gypsy moth pheromone bead formulation in Virginia during 1991. Post-treatment evaluations indicated that most beads are removed from the target foliage over a short period of time. Loss of the AgriSense beads is due to rainfall and the mechanical action of the leaves. To be most effective as a male gypsy moth confusion tool, pheromone needs to be distributed evenly throughout the tree canopy.

The present experimental formulation is applied at one (1) gallon per acre.

Per Acre = 98.6 ounces water
25.6 ounces StaPut
3.8 ounces Bond Sticker
76.0 ounces AgriSense Beads

Nine experimental thickeners/stickers were tested in the laboratory to identify a formulation to replace the present experimental one. The test materials were furnished by Nalco Chemical Company. Dr. Ivan Rash, a Nalco representative, assisted in conducting these tests.

Formulations were prepared and droplets were hand placed onto northern red oak foliage. One droplet approximately 500 ul in size was placed on each of five leaves. Each droplet contained approximately 20 pheromone beads. After drying, the number of individual beads in each droplet were counted and recorded. This was done with the assistance of a standard dissecting microscope. The treated foliage was then exposed to rainfall and/or mechanical agitation and beads counted again to determine percent loss. In some cases, it was not uncommon to find more post-treatment beads than pre-exposure counts. Due to the washing action, some small beads, not exposed before rainfall, are made visible following rain. Unless otherwise stated, all tests were replicated five times.

Initial tests were conducted to screen out formulations with poor performance.

Table 4. Percent recovery of beads after exposure to rainfall following a 2 hour drying time.

Material	Percent Recovery					
	0.5 ^{1/}	1.0	2.0	3.0	4.0	5.0
Bond 3%	97	97	35	33	35	39
TX 7423 26%	0	--	--	--	--	--
TX 7424 26%	65	65	103	103	103	121
TX 7437 26%	0	--	--	--	--	--
TX 7438 26%	88	66	94	113	81	100
TX 7450 26%	0	--	--	--	--	
TX 7476 26%	17	--	--	--	--	
TX 7527 26%	112	130	107	112	111	112
TX 7528 26%	100	98	104	85	79	79
2397 3%	82	110	--	--	--	--
1990 3%	93	93	--	--	--	--
B60A 3%	29	32	32	32	30	30

^{1/}Inches of rainfall following a 2 hours drying time.

Table 5. Percent recovery of beads after exposure to rainfall following a 5 hour drying time.

Material	Percent Recovery					
	0.5 ^{1/}	1.0	2.0	3.0	4.0	5.0
Bond 3%	108	114	64	50	50	36
TX 7423 26%	0	--	--	--	--	--
TX 7424 26%	131	115	68	74	58	65
TX 7437 26%	0	--	--	--	--	--
TX 7438 26%	100	100	103	93	89	89
TX 7450 26%	0	--	--	--	--	--
TX 7476 26%	5	--	--	--	--	--
TX 7527 26%	93	100	112	118	115	115
TX 7528 26%	80	70	94	97	86	97
2397 30%	85	85	--	--	--	--
1990 3%	88	91	--	--	--	--
B60A 3%	114	121	55	44	45	42

^{1/}Inches of rainfall following a 5 hour drying time.

Table 6. Percent recovery of beads after exposure to rainfall following a 19 and 24 hour drying time.

Material	Percent Recovery			
	19 Hours Drying		24 Hours Drying	
	0.5 ^{1/}	1.0	0.5	1.0
Bond 3%	100	100	88	88
TX 7423 26%	0	--	0	--
TX 7424 26%	102	103	80	84
TX 7437 26%	0	--	0	--
TX 7438 26%	107	104	100	100
TX 7450 26%	84	72	0	--
TX 7476 26%	40	21	6	0
TX 7527 26%	108	108	115	108
TX 7528 26%	106	89	100	100
2397 3%	87	71	81	72
1990 3%	94	82	94	91
B60A 3%	93	90	100	101

^{1/}Inches of rainfall following a 19 and 24 hour drying time.

As a result of initial testing, the list of candidate formulations were narrowed to TX 7527 and TX 7438. A new formulation TX 7570 was tested and found to be very effective.

Table 7. Percent recovery of beads after exposure to rainfall of 2 and 5 inches at various drying times.

Material	Percent Recovery				Percent Recovery			
	2 Inches Rain				5 Inches Rain			
	0.5 ^{1/} H	1.0 H	1.5 H	2.0 H	0.5 H	1.0 H	1.5 H	2.0 H
Bond 3%	8	1	5	9	7	1	5	1
TX 7427 26%	104	100	104	111	91	100	102	107
TX 7427 13%	110	98	84	124	106	98	81	120
TX 7427 6%	65	100	80	66	64	100	53	35
TX 7427 3%	23	39	52	34	9	22	42	10

^{1/}Hours of drying time before exposure to rainfall.

Four formulations were dried on foliage for 19 days and then exposed to 5 inches of rainfall. This was to determine if these formulations dried hard over time resulting in the complete drop being removed by rain or the mechanical action of the leaves.

A separate group of treated foliage was exposed to high fan winds for a 2 hour period.

Table 8. Percent recovery of beads after 19 days of drying time and exposure to 5 inches of rainfall and beads exposed to 2 hours under a fan.

Material	Percent Recovery	Percent Recovery
	5 Inches of Rain	2 Hours of Fan Wind
Bond 3%	86	100
TX 7527 26%	95	101
TX 7527 13%	65	90
TX 7527 10%	102	103
TX 7528 26%	92	95
TX 7528 13%	93	72
TX 7528 10%	78	101
TX 7438 26%	89	99
TX 7438 13%	90	93
TX 7438 10%	81	76
TX 7424 26%	81	99
TX 7424 13%	67	98
TX 7424 10%	16	95

A series of tests were conducted to determine any differences between TX 7527, TX 7438 and TX 7570.

Table 9. Percent recovery of beads after 33 days of drying time and exposure to 5 inches of rainfall and beads exposed to 2 hours under a fan.

Material	Percent Recovery	
	5 Inches of Rain	2 Hours of Fan Wind
Bond 3%	95	99
TX 7527 26%	99	101
TX 7527 13%	98	101
TX 7527 10%	100	101
TX 7528 26%	82	99
TX 7528 13%	69	97
TX 7528 10%	47	97
TX 7438 26%	91	94
TX 7438 13%	89	96
TX 7438 10%	90	86
TX 7424 26%	89	97
TX 7424 13%	58	100
TX 7424 10%	47	84

Table 10. Percent recovery of beads after 2 and 24 hour drying time on oak foliage prior to 5 inches of rainfall.

Material	Percent Recovery	
	2 Hours Drying	24 Hours Drying
Bond 3%	29	28
TX 7527 13%	103	113
TX 7438 13%	87	99
TX 7570 13%	104	95

Table 11. Percent recovery of beads after 2 hours of drying time and exposure to 5 inches of rainfall.

Material	Percent Recovery	
	2 Hours Drying Time	
Bond 3%		4
TX 7527 3%		116
TX 7527 6%		125
TX 7438 3%		15
TX 7438 6%		60
TX 7570 3%		46
TX 7570 6%		100

Table 12. Percent recovery of beads after various drying time and exposure to 5 inches of rainfall.

Material	Percent Recovery			
	Drying Time Before Rain			
	30 Minutes	60 Minutes	90 Minutes	120 Minutes
Bond 3%	0	26	9	7
TX 7527 6%	47	36	82	102
TX 7570 6%	15	58	53	56

Table 13. Percent recovery of beads after various drying time and exposure to 5 inches of rainfall.

Material	Percent Recovery					
	Drying Time Before Rain					
	30 Min.	60 Min.	90 Min.	120 Min.	240 Min.	360 Min.
Bond 3%	2	15	9	29	63	87
TX 7527 10%	0	5	39	74	61	41
TX 7570 10%	3	2	82	33	102	102

Table 14. Percent recovery of beads after various drying time and exposure to 5 inches of rainfall.

Material	Percent Recovery					
	Drying Time Before Rain					
	30 Min.	60 Min.	90 Min.	120 Min.	240 Min.	360 Min.
Bond 3%	1	9	14	24	38	43
TX 7527 13%	2	33	107	106	90	88
TX 7570 13%	7	36	95	95	94	97

Table 15. Percent recovery of beads dried on oak foliage for 2 hours then exposed to various amounts of rainfall.

Material	Percent Recovery			
	1 Inch ^{1/}	2 Inches	3 Inches	5 Inches
Bond 3%	12	11	11	9
TX 7527 3%	41	32	33	23
TX 7527 6%	104	100	93	88
TX 7527 10%	113	110	106	85
TX 7570 3%	130	120	124	93
TX 7570 6%	98	85	93	86
TX 7570 10%	111	95	109	92

^{1/}Inches of rain applied to treated foliage following 2 hours of drying time.

TX 7527 and TX 7570 formulations are superior to the Bond standard. In these tests, TX 7570 appears to be more effective than TX 7527 at low dosages (see Table 15). At dosages of 13 percent and higher both are equally effective.

During April 1992, TX 7527, TX 7570 and StaPut with Bond were tested in an aircraft at Mission, Texas. Although the material mixed and sprayed well, there was less than the desired bead suspension.

Additional testing was conducted at the Otis laboratory and it was determined that the TX 7719 formulation did a suitable job in keeping beads in suspension and was also rain resistant.

In May, a dosage response test was conducted with TX 7719. Dosages of 3, 6, 15 and 30 grams of active pheromone per acre were applied by aircraft. Laboratory reared gypsy moth were used as test insects. One female was mated in the 6 gram treatment and 15 percent of the control insects were mated.

In June and early July, AgriSense beads were applied to 178 acres of forest lands in Virginia. Two applications were applied two weeks apart at 6 grams active pheromone per acre.

A post-season dose response test will be conducted using the same dosages as the pre-season test.

Although the 10 percent TX 7719 formulation mixes and sprays well, work will continue to improve the mix.

For regulatory purposes, creosote was used for years to treat gypsy moth egg masses. Recently, creosote and creosote products have been removed from the marketplace. Therefore, there is a need for an effective regulatory treatment for gypsy moth egg masses.

Field test during the past few years have demonstrated the effectiveness of soybean oil when sprayed directly onto viable egg masses. However, before such material can be recommended for this type of treatment, it must be registered as an insecticide. Stoller Inc. agreed to register their Golden Natur'l Spray oil (93 percent soybean oil) for treatment of gypsy moth egg masses. The material was tested in the field against viable egg masses during the winter of 1992.

Golden Natur'l Spray Oil from Stoller Inc. was used to treat North American gypsy moth egg masses in the field. Four dosages were used with water being the diluent. Hatch was prevented with all dosages except the lowest one tested.

Healthy, naturally occurring gypsy moth egg masses were located on oak and white pine at Freetown State Forest, Freetown, Massachusetts. Five survey lines were established through the woods off a pipe line. Lines were parallel, approximately 100 feet apart. A total of 120 egg masses were identified and marked on each line. All egg masses were between one and six feet above the ground. A small number of the test egg masses were covered with snow for very short periods of time during the test period.

Twenty untreated egg masses were treated with each dosage. Six treatment dates were used between January 29 and April 22. New previously untreated egg masses were treated at each treatment time. All egg masses in the study received only one treatment. Treatments were made over a period of time to determine if age of eggs effected treatment results. Twenty untreated egg masses were identified as a control for each treatment time. Treated egg masses were marked with colored pins and left in their natural environment until collected for hatchability tests in late April. Different color pins were used to identify treatment times. The Golden Natur'l Spray Oil was applied directly to individual egg masses using a one gallon, hand held, pump up sprayer. Egg masses were sprayed until thoroughly saturated with the oil. The spray nozzle was held approximately 8 to 12 inches from the egg mass when the spray material was applied. All dosages appeared to be absorbed rapidly by the egg masses.

The temperature ranged between 25 and 50 degrees fahrenheit when treatments were made.

On April 24th, all treated egg masses and controls were removed from the woods and returned to the laboratory for hatchability tests.

Egg masses were removed from the trees by use of a knife and placed individually into plastic petri dishes. Dishes with egg masses were held in an environmental chamber at 78°F with 50 percent RH. Egg masses were observed daily for hatch.

The untreated eggs started hatching within 4 days with heavy hatch occurring on days 5 and 6. Hatch in controls was estimated to be 90 percent. This would be a typical hatch for field eggs in a healthy, building population. Light hatch occurred with eggs treated with a low dosage of spray oil. No hatch occurred in eggs treated with the 3 highest dosages.

Table 16. Percent hatch of gypsy moth egg masses treated with Golden Natur'l Spray Oil.

Formulation	Treatment Dates					
	1/29/92	2/21/92	3/10/92	3/26/92	4/8/92	4/22/92
100% ^{a/}	0	0	0	0	0	0
50% ^{b/}	0	0	0	0	0	0
25% ^{c/}	0	0	0	0	0	0
5% ^{d/}	21 ^{e/}	4	7	5	6	3
Control	90 ^{e/}	90	90	90	90	90

^{a/} Used undiluted, 100 percent of concentration

^{b/} 50 percent of concentrated formulation

^{c/} 25 percent of concentrated formulation

^{d/} 5 percent of concentrated formulation

^{e/} Estimated hatch

Based on these data, Golden Natur'l Spray Oil is effective in preventing North American gypsy moth eggs from hatching when sprayed directly onto the individual egg masses between January 29th and April 22nd. A dosage of 50 percent of the concentration should be used and egg masses must be thoroughly saturated. Water can be used as a diluent.

These data support two previous field tests that demonstrated Soybean oil's effectiveness against gypsy moth egg masses. Previous tests were started in September and terminated in April. Therefore, it is reasonable to say that such treatments with Golden Natur'l Spray Oil would be effective throughout the gypsy moth egg stage.

Effects of *Bt* (*Bacillus thuringiensis*) on Asian gypsy moth larvae have been similar to results when used against North American gypsy moth larvae. Most likely Golden Natur'l Spray Oil will be as effective when used against Asian gypsy moth eggs as it is when used on the North American strain.

FOR GOLDEN NATUR'L SPRAY OIL LABEL

Gypsy Moth

Golden Natur'l Spray oil is recommended for application to gypsy moth egg masses to prevent hatch of eggs. Treat egg masses that have been deposited on trees, ground litter, outdoor furniture, recreation vehicles, firewood, nursery stock, rocks, vessels, aircraft and other forms of transportation. Treat egg masses between August and May.

Mixing Directions

Mix equal amounts of Golden Natur'l Spray oil and water and apply to egg masses as a 50 percent mix. Make a new mix each day treatments are made.

Application Technique

With use of a small hand sprayer, treat individual egg masses until they are completely saturated with the spray solution. Keep the mix agitated while treating. General application by mist blower, hydraulic sprayer or aircraft is not recommended. It is important that the egg mass is saturated with spray. Following treatment, egg masses can be left in place or removed and incinerated.

Do not exceed maximum rate or apply when not recommended.

During March, 1992, Dimilin was tested at Las Cruces, New Mexico to determine what adjuvant might be suitable for eliminating excessive evaporation. Intact, StaPut and 1986 were tested at various rates with Dimilin 4L. Final results have not been determined at this time.

Foray 48B was tested for evaporation at Las Cruces, New Mexico. The material was applied undiluted at 64 ounces per acre using Micronair atomizers. All spray cards have not been evaluated at this time.

Spray trials were conducted near Warren, Pennsylvania during 1992. Applications were made in late May using a Cessna Ag-truck aircraft.

PENNSYLVANIA SPRAY PLOTS 1992

<u>Treatment</u>	<u>Dosage/Rate</u>	<u>Plot</u>	<u>EM/Acre</u>	<u>Acres</u>
Foray 76B	24 BIU/40 oz.	32	256	50
		25	2,106	50
		23	2,672	50
Foray 76B	38 BIU/64 oz.	36	1,234	50
		4	120	50
		20		50
Foray 48B	24 BIU/64 oz.	22	2,152	50
		39	746	50
		35	998	50
Azadirachtin	8 oz./128 oz.	1	772	50
		9	1,934	50
		17	2,020	50
Azadirachtin	4 oz./128 oz.	2	125	50
		12	4,404	50
		11	1,134	50
Dimilin 4L	.03 lbs./128 oz.	83	772	50
		82	2,659	50
		80	2,462	50
Dimilin 4L	.03 lbs./64 oz.	84	914	50
		81	2,472	50
		10	1,106	50
Dimilin 4L + Intact	1 oz./64 oz.	18	900	50
		5	1,168	50
		3	142	50
Dimilin 4L + 1 oz./64 oz. 1986	1 oz./64 oz.	16	734	50
		6	652	50
		14	534	50
Control	--	40	706	50
		38	778	50
		31	900	50
		33	884	50

See graphs at end of this report.

Recommendations from the 1991 Blacksburg, Virginia meeting:

II. NATIONAL NEEDS/CURRENT ACTIONS

A. National Needs

2. a. Evaluate, modify and/or develop application equipment for gypsy moth pheromones.

During 1992, the Hercon flake dispensers continued to be a major problem. K&K Aircraft, Inc., Bridgewater, Virginia have worked on and developed a new system to disperse flakes from a twin beach aircraft. This system appears to be superior to the one presently used, however, it was not tested operationally in 1992.

7. b. Develop replacement for the milk carton DDVP trap:

Other materials were tested in 1992. No material looked anywhere near as good as DDVP. Baythroid and Guthion were effective to a lesser degree than DDVP.

B. Current Actions

1. Pilot Training

The chairperson and committee members discussed this topic a number of times during the year with no action being taken.

III. 1990 RECOMMENDATIONS AND OTHER CONTINUING NEEDS

B. Field Tests

1. Testing of lower doses/volumes of Dimilin and anti-evaporants is continuing. Dimilin 4L was not tested in 1991 due to lack of suitable test sites.

Work was conducted during 1992 with a lower volume of Dimilin at Warren, Pennsylvania. The objective was to identify an adjuvant that would reduce the amount of evaporation. Based on larvae counts and defoliation, intact and 1986 did not eliminate any evaporation.

Tests were also conducted at Las Cruces, New Mexico to select adjuvants to be used in the Warren, Pennsylvania study.

No work was done during 1992 with dosages lower than .03 lbs. AI/A. No low volume work was done under 64 ounces per acre.

E. Administrative

1. Win McLane, Mike McManus and Dick Reardon will review and revise tank-mix recommendations for 1992.

Recommendations for 1993

<u>Product</u>	<u>BIU/Acre</u>	<u>Volume/Acre</u>	<u>Nozzles</u>
Dipel 6AF ^{1/}	16-30 (diluted) 16-30 (undiluted)	96-128 oz. 43-80 oz.	Flat fan micronair beecomist
Dipel 8AF ^{1/}	16-30 (diluted) 16-30 (undiluted)	96-128 oz. 32-60 oz.	Flat fan micronair beecomist
Foray 48B ^{1/}	16-30 (diluted) 16-30 (undiluted)	96-128 oz. 43-80 oz.	Flat fan micronair beecomist
Thuricide 48LV	16-30 (diluted) 16-30 (undiluted)	96-128 oz. 43-80 oz.	Flat fan micronair beecomist
Dimilin 25W	(2)	128 oz.	Flat fan
Dimilin 4L	(3)	128 oz.	Flat fan

Footnotes:

- ^{1/} For eradication double or triple application required
^{2/} Apply Dimilin 25W at 0.03 lbs. AI/acre or 2 ounces of formulation per acre.
^{3/} Apply Dimilin 4L at 0.03 lbs. AI/acre or 1 ounce of formulation per acre.

The most common *Bt* application during 1992 was 24 BIU/64 ounces/acre, undiluted. This treatment was applied through flat fan, micronair and beecomist nozzles. However, individual states used treatments of 12 to 36 BIU per acre, diluted and undiluted, with all kinds of equipment.

F. Other Continuing Needs

9. Continued need to evaluate stickers and UV screens for tank-mixes.

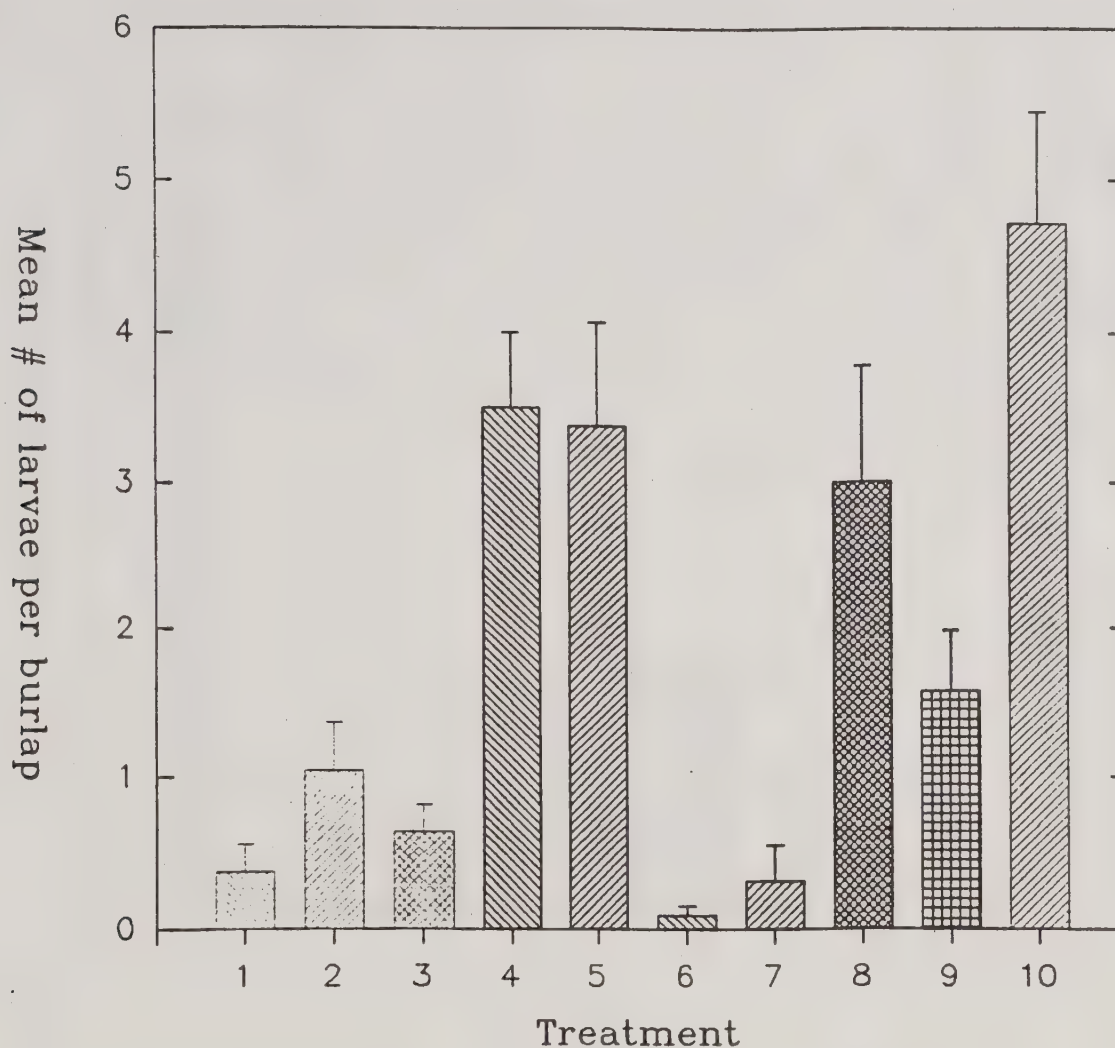
This is a continuing process at the Otis Methods Development Center.

10. Need to develop formulations for pheromones.

As reported in this report, pheromone formulation work continues in the laboratories of Nelco and the Otis Methods Center. Field work has been and continues to be conducted at Mission, Texas and in Virginia.

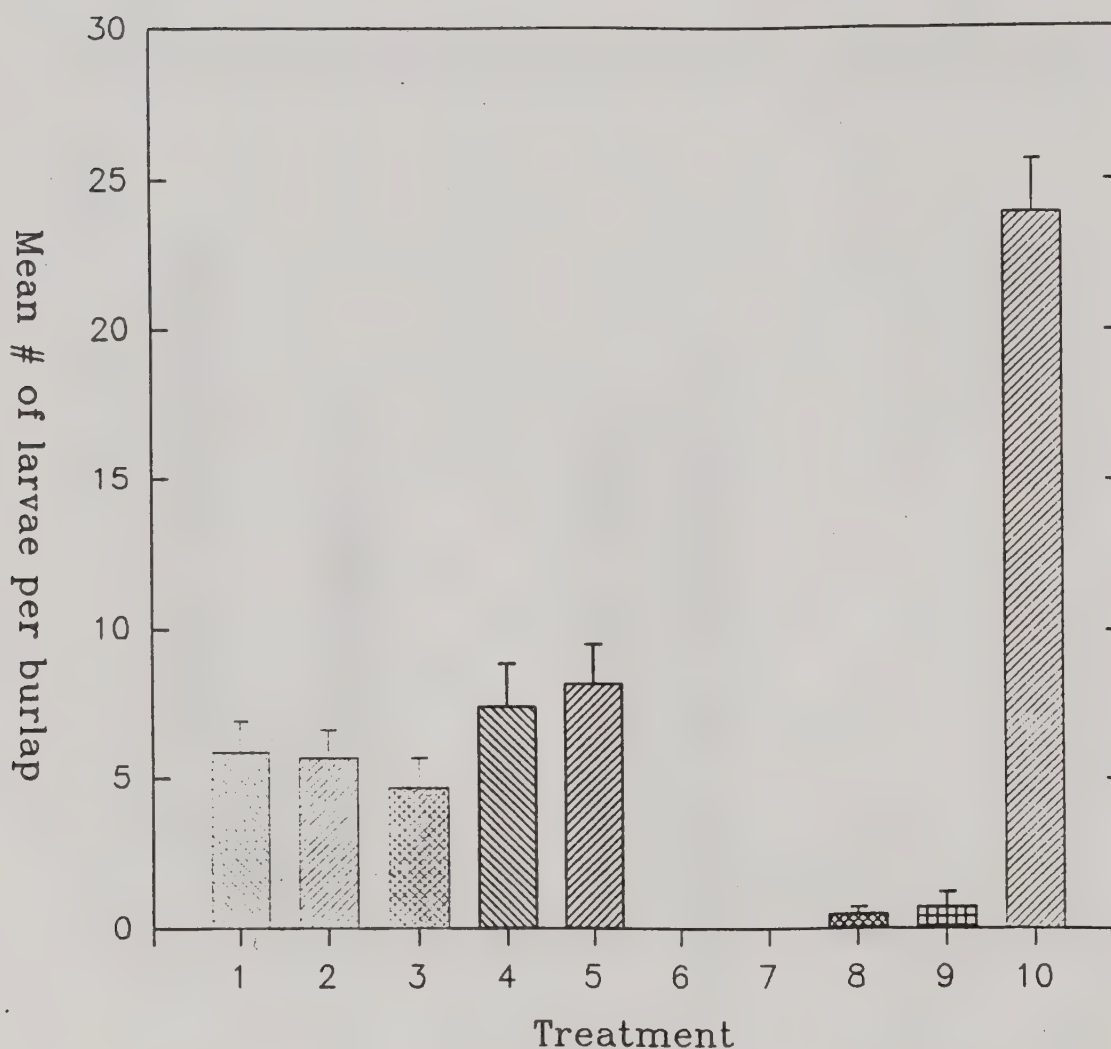
Larval Count on Experimental Plots

July 23-25, 1992 Warren, PA



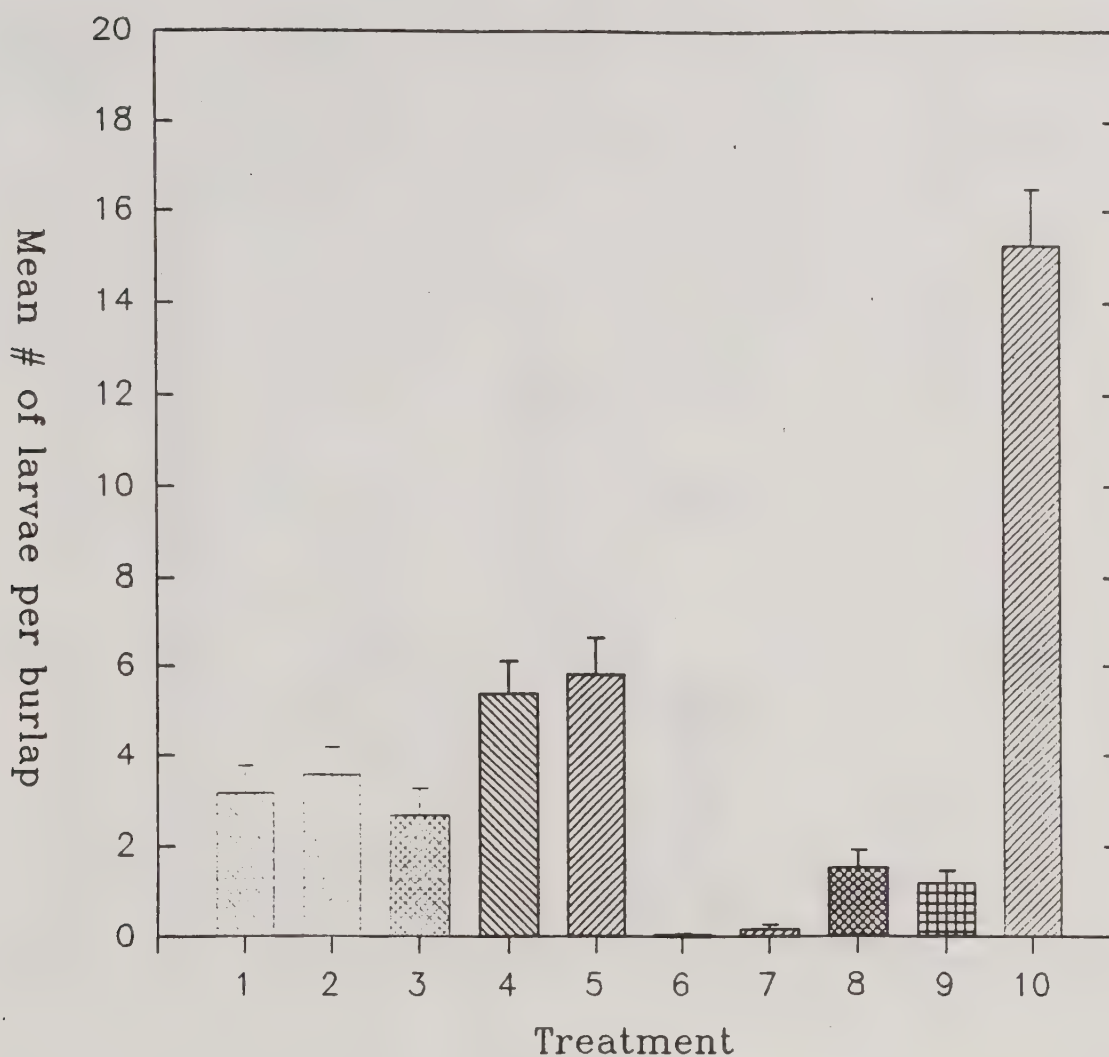
Treatment		
	Material	Rate
1	Foray 76B	24 BIU/40 oz.
2	Foray 76B	38 BIU/64 oz.
3	Foray 48B	24 BIU/64 oz.
4	Azadirachtin	8 oz./128 oz.
5	Azadirachtin	4 oz./128 oz.
6	Dimilin 4L	.03 lbs./128 oz.
7	Dimilin 4L	.03 lbs./64 oz.
8	Dimilin 4L + Intact	1 oz./64 oz.
9	Dimilin 4L + 1 oz. /64 oz. 1986	1 oz./64 oz.
10	Control	

Larval Count on Experimental Plots
August 10-12, 1992 Warren, PA



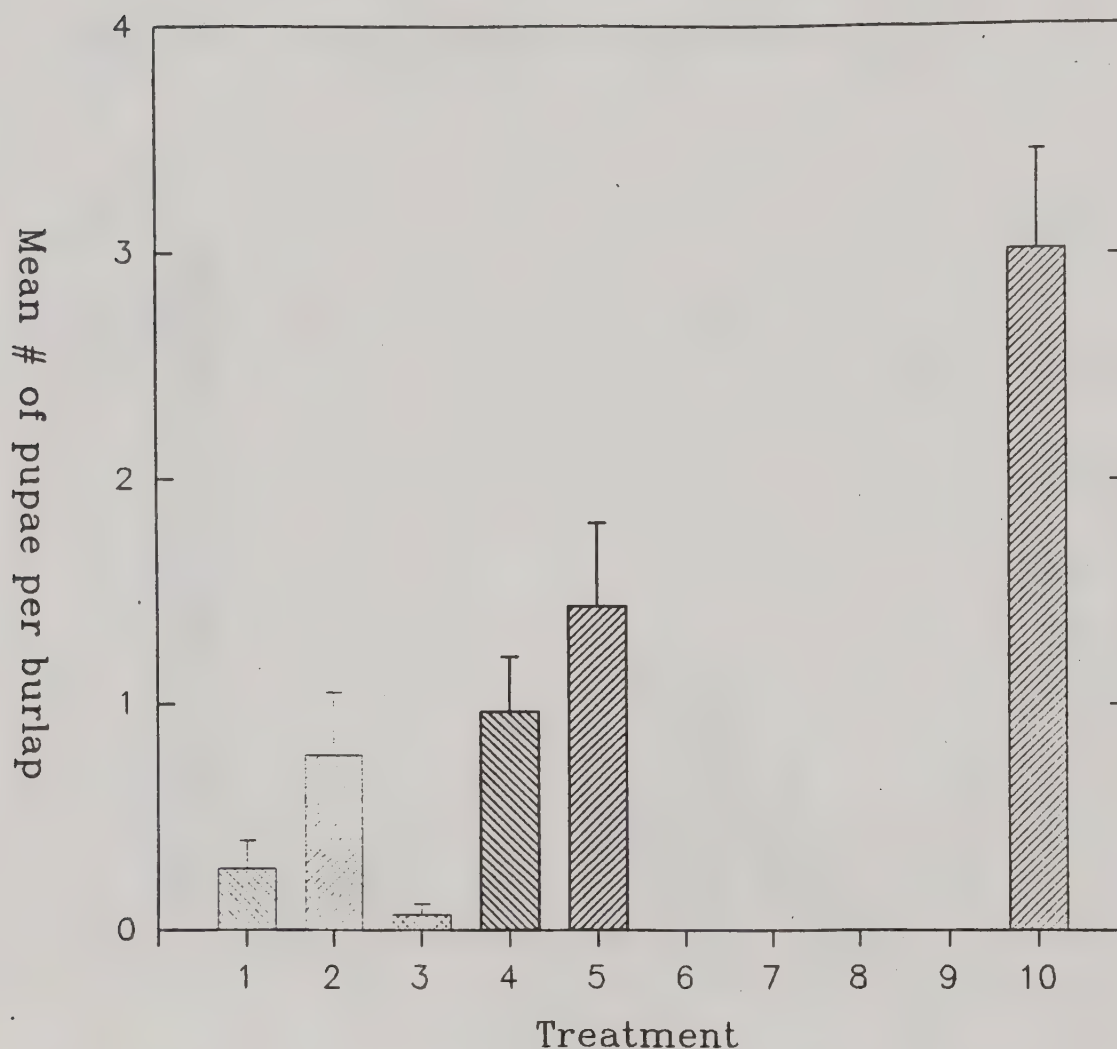
Treatment		
	Material	Rate
1	Foray 76B	24 BIU/40 oz.
2	Foray 76B	38 BIU/64 oz.
3	Foray 48B	24 BIU/64 oz.
4	Azadirachtin	8 oz./128 oz.
5	Azadirachtin	4 oz./128 oz.
6	Dimilin 4L	.03 lbs./128 oz.
7	Dimilin 4L	.03 lbs./64 oz.
8	Dimilin 4L + Intact	1 oz./64 oz.
9	Dimilin 4L + 1 oz. /64 oz. 1986	1 oz./64 oz.
10	Control	

Larval Counts on Experimental Plots
July and August 1992 – Combined
Warren, PA



Treatment		
	Material	Rate
1	Foray 76B	24 BIU/40 oz.
2	Foray 76B	38 BIU/64 oz.
3	Foray 48B	24 BIU/64 oz.
4	Azadirachtin	8 oz./128 oz.
5	Azadirachtin	4 oz./128 oz.
6	Dimilin 4L	.03 lbs./128 oz.
7	Dimilin 4L	.03 lbs./64 oz.
8	Dimilin 4L + Intact	1 oz./64 oz.
9	Dimilin 4L + 1 oz. /64 oz. 1986	1 oz./64 oz.
10	Control	

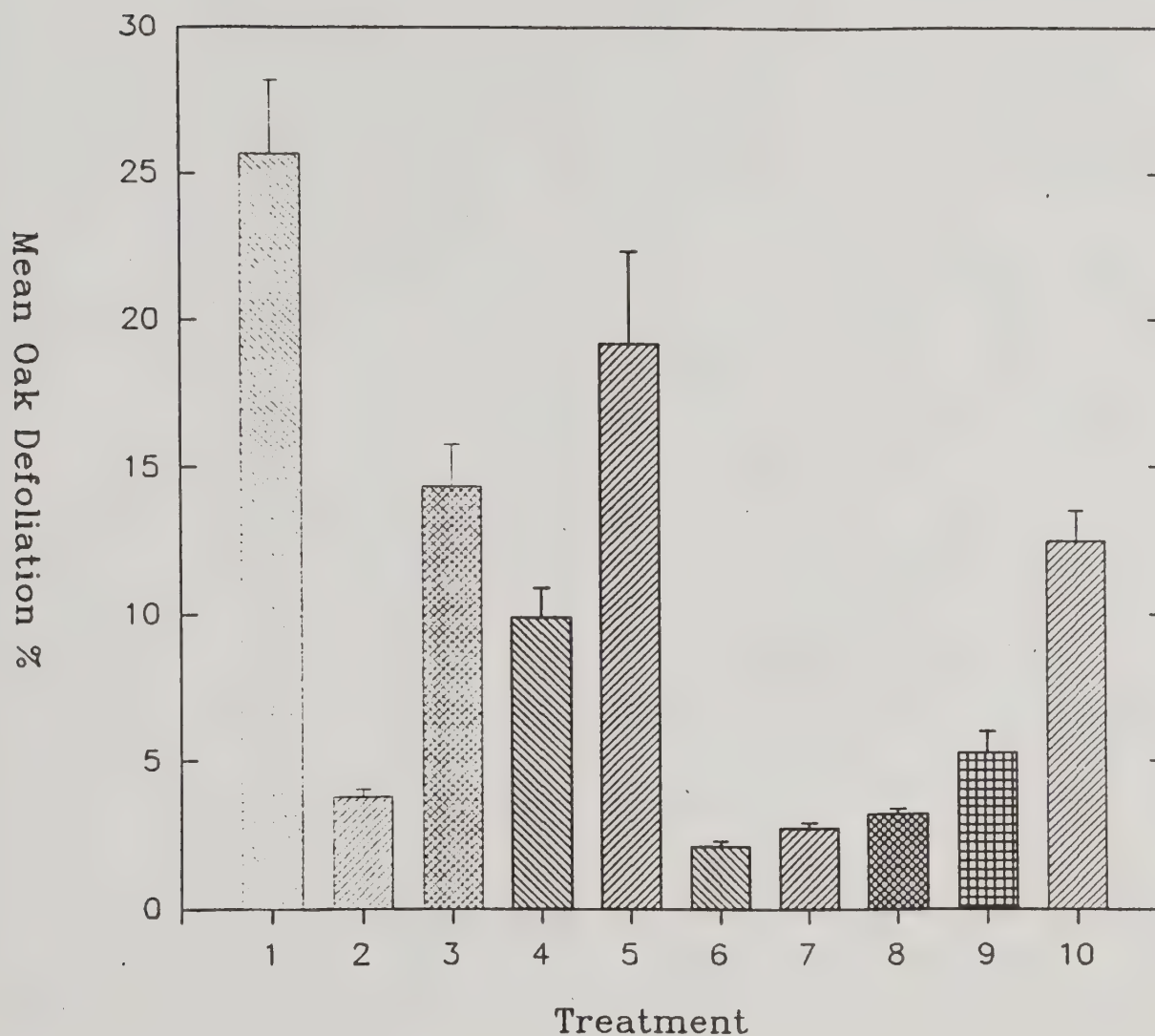
Pupa Count on Experimental Plots
August 10-12, 1992 Warren, PA



Treatment		
	Material	Rate
1	Foray 76B	24 BIU/40 oz.
2	Foray 76B	38 BIU/64 oz.
3	Foray 48B	24 BIU/64 oz.
4	Azadirachtin	8 oz./128 oz.
5	Azadirachtin	4 oz./128 oz.
6	Dimilin 4L	.03 lbs./128 oz.
7	Dimilin 4L	.03 lbs./64 oz.
8	Dimilin 4L + Intact	1 oz./64 oz.
9	Dimilin 4L + 1 oz. /64 oz. 1986	1 oz./64 oz.
10	Control	

Oak Defoliation of Experimental Plots

Warren, PA 1992



Treatment

Material

Rate

1	Foray 76B	24 BIU/40 oz.
2	Foray 76B	38 BIU/64 oz.
3	Foray 48B	24 BIU/64 oz.
4	Azadirachtin	8 oz./128 oz.
5	Azadirachtin	4 oz./128 oz.
6	Dimilin 4L	.03 lbs./128 oz.
7	Dimilin 4L	.03 lbs./64 oz.
8	Dimilin 4L + Intact	1 oz./64 oz.
9	Dimilin 4L + 1 oz./64 oz. 1986	1 oz./64 oz.
10	Control	

Mike McManus

Reply to: 4500

Date: July 31, 1992

Subject: Report - National Steering Committee for Management of Gypsy Moth
and Eastern Defoliators

To: John W. Barry

Because I will not be able to attend the annual meeting in Albuquerque, I promised to send you a report of ongoing research activities in my work unit. Some of these activities do address recommendations and continuing needs that were identified at the Blacksburg, VA meeting. Please feel free to use all or part of what I have provided either at the meeting or for the Proceedings.

Many of the needs that were discussed at last year's meeting involved either the gypsy moth in the west or the Asian Gypsy Moth (AGM); consequently I have also submitted a narrative for a research and development program on the AGM that is now funded and underway at the Northeastern Forest Experiment Station. This program is mainly centered in RWU-4501 under the direction of Dr. Michael Montgomery, however other research work units and many cooperators are actively involved. This narrative should be included in your 1992 report.

I regret that I will not be attending but trust that you will have a productive session.



MICHAEL L. MCMANUS
Project Leader

Encls(2)

Narrative of Proposed Research on the Asian Race of the Gypsy Moth

Background

The gypsy moth is a native of both Asia and Europe. Until recently, it was believed that all the gypsy moths in the United States originated from a single introduction from Europe that occurred more than 100 years ago. During the summer and fall of 1991, gypsy moth of Asian origin were detected near three ports on the West Coast of North America.

The Asian race of gypsy moth differs from the European race in an ability to more successfully utilize a broader range of host plants and in the females being strong fliers. Females are reported to fly up to 30 km and are attracted to electric lights. If this race of gypsy moth becomes established in North America it has been predicted that it may spread three times faster than the European race. More importantly, it may be very difficult to contain isolated infestations. Since long distance female flight occurs after mating, it may also be very difficult to localize infestations based on data from captures of male moths in traps as currently done. This would make it very difficult to delimit and contain isolated infestations.

Three infestations of the Asian race of the gypsy moth have been identified in North America: near Vancouver, British Columbia; near Tacoma, Washington; and near Portland, Oregon. Ships attempting to enter ports in these cities have been found to have egg masses on their superstructures, cargo and other areas. Some of these ships had several thousand egg masses on them. These ships had previously visited ports in the Far East of Russia, where apparently there are outbreaks of gypsy moth in nearby forests. There are plans to eradicate the three known infestations on the West Coast in the spring of 1992.

First year costs associated with applying microbial pesticides and intense monitoring with pheromone traps are estimated to exceed \$14 million. If the infestations are not eradicated potential loss of resources could exceed \$3 billion over the next 40 years. Asian gypsy moth is a serious pest of larch in Siberia and the Far East. Even if only larch were impacted, losses could exceed \$0.8 billion even under the best case scenario. (Loss estimates prepared by FPM-WO and FPM-PNW region.)

Research Planning

A meeting of researchers and regulatory personnel from the United States and Canada was held in East Windsor, CT, in November, 1991 to discuss research needs. The meeting focused on regulatory needs of immediate concern including: (1) methods to detect and delimit any populations of Asian gypsy moth that may be present in North America, (2) technology to assure eradication of the detected populations, and (3) means to reduce the likelihood that further introductions of the Asian race of gypsy moth would occur. Research activities were identified at the meeting and later ranked for priority by the participants to obtain a plan of highest priority research.

Because the Asian race of the gypsy moth is considered an exotic pest, all research on it must be conducted either in containment facilities for high risk arthropods or in its Asian homeland.

There is an urgency to provide a successful prevention-eradication program for the Asian gypsy moth because if it becomes established, mitigation procedures will be much more costly and less likely to be fully successful. The proposed research is to be completed within three years and tasks that can quickly satisfy informational needs quickly will be emphasized.

Research Plan

1. Detection and Delimitation of Populations

1.1 *Detection (Trap capture of males)*

Placement of traps baited with a pheromone attractive to male gypsy moths is the most sensitive way to detect the presence of gypsy moths in an area. The male Asian gypsy moth is attracted into traps baited with the standard lure routinely used for survey of gypsy moth in the United States, but it is not known if this is the optimal lure for the Asian race. There is a need to evaluate the attractiveness of release rates and chemical blends. These studies, along with periodicity of male response, flight propensity and duration, should be conducted in the field (Far East). This should be followed with air-borne collections and gland extracts in laboratory studies to determine what the female actually is emitting as a pheromone and the periodicity of emission. Male responses to inhibitors such as the olefin precursor should also be examined in laboratory flight tunnels. The most important work in the laboratory would be to evaluate the mating behavior and physiology of hybrids and backcrosses in order to predict the behavior of these in relation to the Asian and European parent stocks.

1.2 *Female flight*

The capability of mated female moths of the Asian race to fly distances of several kilometers makes it difficult to rely solely on capture of adult males to predict where egg masses are located. It is the flight of females to electric lights that is responsible for the occurrence of egg masses on ships from ports in the Russian Far East. Studies need to be conducted to determine the flight period and distances of female flight. Also the portion of the visible light spectra that is attractive to female moths must be determined in order to change electric lighting to make it less attractive to flying females. Aspects of these studies can best be done in the Far East, but they must be coupled with studies in the quarantine laboratory using circular flight mills and other specialized equipment. This information is critical for defining areas that require eradication treatments, predicting the rate of spread of an established Asian gypsy moth population, and for developing ways to reduce the flight of females to ships and cargo in lighted ports.

1.3 *Larval dispersal*

The occurrence of Asian gypsy moth in North America is likely due to the dispersal of newly hatched larvae from ships docked in North American ports to suitable host plants on land. Models used to predict dispersal of the European race of gypsy moth can be used to predict the likelihood of Asian gypsy moth larvae dispersing a given distance inland from ships in port or in harbors. The weather information compiled for these simulations also can be used to define the time of the day when pesticides can be applied most effectively.

2. Diagnostics (Recognition of Races)

2.1 *Taxonomy and population variation*

The finding of Asian gypsy moth in North America and the ensuing confusion about whether this is a strain, race or subspecies illustrates a generally poor understanding among those concerned with this problem of the taxonomic infrastructure of *Lymantria dispar*. Considering the worldwide pest status of the gypsy moth, the lack of a comprehensive description of the many varieties, forms, geographical races and subspecies is surprising. There is a need to clarify the phylogenetic and systematic relationships among geographic populations of the gypsy moth. A good representation of Asian, European, and North American populations should be assembled and examined using both classical and molecular methods to clarify the phylogenetic relationships between and within geographic populations.

2.2 Mitochondrial DNA markers

It is very difficult to recognize by visual examination if a moth caught in a trap is of Asian or European ancestry. Confirmation that the Asian gypsy moth was present in North America was obtained with one of a group of molecular genetic methods commonly referred to as "DNA fingerprinting". About 6 years ago using a Competitive Grant Research Program award, a Cornell University and a Northeastern Forest Experiment Station scientist employed restriction endonuclease to estimate genetic mitochondrial DNA (mtDNA) divergence within and among gypsy moth populations from North America, Europe and Asia. More recent advances by others, especially the polymerase chain reaction (PCR) made it possible to examine mtDNA sequences in a large number of moths that were air-dried (caught in traps). This technique needs to be refined and simplified for use in a diagnostic laboratory setting where many moths would be examined daily. Additional mtDNA markers need to be identified and additional samples from both North America and Asia need to be examined to better define variation in genotypes (DNA) among populations.

2.3 Nuclear gene markers

Since mtDNA is transferred to offspring only by the female, additional diagnostic tests must be developed to detect individuals of mixed Asian and European parentage. To identify how many generations of interbreeding have occurred will require a number of unlinked diagnostic markers. Also methods are needed to screen bulk samples in order to detect one Asian moth in a batch of several moths. Several types of nuclear gene diagnostic tests can be developed to achieve these objectives. Tests using single copy or repetitive genes are among the easiest to develop and can also be used on bulk samples. Another approach is to generate nuclear gene markers by random amplification of polymorphic DNA (RAPD). This technique provides not only for identification, but also can be used to generate genetic markers that can be correlated with specific phenotypic traits such as female flight. This allows an assessment of the propensity of specific traits to become fixed in hybrid populations.

2.4 Wing venation

Morphological techniques can also play a role in distinguishing whether a gypsy moth is of Asian or European ancestry. Wing venation has been used to examine some of the same samples of Asian and North American gypsy moth submitted to mtDNA analysis. In most cases, the two methods agree in their diagnosis of parentage, but with some individuals, diagnosis based on wing patterns was inconclusive. Although not as definitive as genetic analysis, diagnosis using morphological characters is less expensive and can be useful where a quick, preliminary assessment of parentage is needed.

3. Seasonal Timing of Life Stages

3.1 *Predictive models*

Knowing when egg masses will hatch is important for the timing of insecticide applications and in determining when there is a high risk of dispersal of larvae from ships infested with egg masses. Unfortunately, development of a robust model to predict egg hatch has not been realized even for the European race, in part because the physiology of the diapause process is not well understood. In addition, it appears that the Asian gypsy moth may have different thermal requirements than the European race. Heat accumulation models to predict egg hatch of the European race will need to be refined and adapted to Asian gypsy moth.

It should not be difficult to predict the seasonality of Asian gypsy moth life history events subsequent to egg hatch if actual observations of egg hatch are obtained or reliable egg hatch predictions developed. Models of larval development and adult eclosion should proceed quickly once a generation of the Asian race is reared in the laboratory. Larval development and adult eclosion models developed for North American populations work well and can likely be reparameterized for the Asian race. Although good, accurate egg hatch models will take considerable effort and time, preliminary models can be developed from existing information. Once the heat accumulation model of the diapause process is defined, it would be possible to predict hatch of egg masses laid on ships if information on their routes can be obtained.

4. Host Plant Susceptibility

4.1 *Determination of insect host range and susceptible time-window*

The immediate concern with the Asian gypsy moth is that it will become established in North America. To do this, it only needs to find host plants on which it can survive. Thus, the research objective is different than for populations established in North America, where the concern is whether the quality of the host plant is sufficient to enable the gypsy moth to increase to densities that may cause damaging defoliation or other nuisance. Initially, potential urban hosts found in port areas should be bioassayed. These tests should focus on species that have not been examined for susceptibility to the European race; e.g., big leaf and vine maples, western cottonwoods, mandrone hawthorne, blackberry, ornamental plums, and cherries.

A second activity is to determine if major forest species can promote high density populations or are susceptible to defoliation. Larch, aspen, Douglas-fir, and hemlock are among the species to consider. In these studies it is

important to recognize that geographic races of many western species occur and that they may differ in susceptibility.

A third consideration is the time frame when the hosts are susceptible. It is particularly important to determine the period of the Asian gypsy moth egg hatch and the hosts that are suitable during this period. Newly hatched larvae have a narrower host range than older larvae and the age of the host can be critical for young larvae.

5. Genetics and Life History Traits

5.1 *Produce and characterize phenotypes*

Information obtained from genetics and life history studies will be used to refine detection techniques, address control issues, develop phenological models (for hatch and development), and to determine the potential for establishment and spread of the Asian race or hybrids resulting from crosses with the European race. The parental stocks of the gypsy moth races involved, their hybrids, and backcrosses must be characterized phenotypically. Phenotypic characteristics such as diapause, larval development, larval/pupal weight, mating success, fecundity, hatch phenology, coloration, flight behavior, susceptibility to microbial pesticides, etc., need to be documented. In addition, the compatibility of the races must be determined.

To document phenotypic variability and to determine compatibility, large scale rearings need to be done in the quarantine laboratory. All of these experiments should be designed to eliminate deleterious effects that may arise from founder effects, genetic drift, inbreeding and assortive mating when too small a gene pool is used for initiation or maintenance of a laboratory strain. Therefore, parental stock of more than one strain from each race must be used to establish and maintain colonies with large gene pools. These colonies can be used for the production of reciprocal crosses, F_2 generation, and backcrosses. Material from these rearings will be used for several other studies: DNA diagnostic tests, host plant preferences, morphological markers for detection, etc.

6. Provide Regulatory Options

6.1 *Identify outbreak areas in Russia*

The current problem of ships infested with egg masses of the Asian race of gypsy moth can be traced to a population outbreak of the gypsy moth near ports in the Russian Far East. The location and extent of these outbreaks should be identified. Further, other port areas should be surveyed for the

occurrence of gypsy moth. This will allow regulators to risk rate vessels from the Far East and the shipping industry may be able to avoid high risk ports. Forests also should be classified for susceptible-type so that areas where outbreaks are most likely to occur can be identified. Finally, a monitoring system needs to be implemented so that population densities can be determined. Here, methods used in North America need to be compared with methods used in the region. Because the females fly, it is important to examine what the influence of the capability of the female to select oviposition site has on the design and interpretation of egg mass survey data.

6.2 *Reduce deposition and occurrence of egg masses on ships*

Egg masses laid on ships while in Far Eastern ports seem to be the primary source of the Asian gypsy moth inoculum reaching North American shores. The ova-laden females are attracted to these ships by the electric lights that illuminate them at night. It may be possible to propose ways that lighting in ports can be changed to reduce oviposition on ships. This strategy will require knowledge about the effect of light spectra, intensity and placement on the flight behavior of female moths. Lamps, such as sodium vapor, should be field tested in Russia. These lamps are used routinely in this country but are not available in Russia.

Currently, detection of egg masses on ships is achieved through labor-intensive visual inspection by trained personnel. Egg masses are then either scraped from surfaces or disengaged by using high pressure water from on-board hoses. Application of pesticides to kill gypsy moth egg masses may not be feasible for several reasons such as the possibility of contamination of the grain carried by many of these ships and the difficulty of determining if such treatments have been applied correctly and thoroughly. While there is a clear need for better methods of detecting and removing egg masses on ships, there is a paucity of good, practical ideas. Several suggestions regarding the implementation of protocols and inspections in Asian ports may have merit, but are more regulatory and political problems than research problems.

6.3 *Toxicity of registered pesticides*

Programs to eradicate the Asian gypsy moth will rely on aerial application of the same pesticides that are currently registered for use against the European race. Laboratory bioassays using commercially available formulations of *Bt* should be conducted to assess the effect of these products on the Asian race and hybrids. Since most applications will be made in urban situations, it is important to evaluate the persistence of neat *Bt* formulations under conditions of high relative humidity and frequent rainfall. Other candidate pesticides, including Gypchek and diflubenzuron, should also be evaluated through laboratory bioassay in order to evaluate their potential utility against the Asian gypsy moth.

Bt. Laboratory bioassays conducted in 1990-91 indicated that FORAY 48B was effective against 3rd and 4th instar gypsy moth larvae; consequently, a field study was conducted in 1991 to evaluate this product. Results from this initial study demonstrated that there was a significant reduction in larval populations in treatment vs. control plots, however reductions in egg masses were not significant because of a population collapse in many of the control plots due to the nucleopolyhedrosis virus. Therefore the study was repeated in 1992 on 30A. blocks near Warren, PA, in cooperation with the Northeast Forest Aerial Application Group (NEFAAT) and the AIPM Project. Results of larval counts beneath burlap again indicate that a single application of Foray 48B applied undiluted at 36 BIU/A caused a significant reduction in 3rd and 4th stage larvae. Egg mass counts will be obtained in the Fall.

A single application of FORAY 48B (36 BIU, 96 oz.) was also field tested against low density gypsy moth populations near Clarion, PA. in cooperation with NEFAAT and AIPM. The purpose of this study is to evaluate the feasibility of using Bt against gypsy moth populations at densities similar to those likely to be encountered in the proposed "Slow the Spread" project area. Results are pending based on Fall egg mass counts.

Norm Dubois also cooperated with Jeff Witcosky (R-8) to evaluate the efficacy of Thuricide 48LV on 3rd and 4th instar gypsy moth larvae on the George Washington National Forest near Wardensville, W.VA. Another aspect of this study was designed to test the efficacy of two different droplet VMD's applied with a boom and nozzle system.

Dr. Dubois is also cooperating with K.M.S. and A. Sundaram in measuring the spray distribution, deposition, and persistence of Bt (K) in hardwood forest canopies in West Virginia, Virginia, and Pennsylvania. Preliminary aspects of this work were reported by B.L. Cadogan, FPMI, in the Fourth Report of the Steering Committee (Nov. 1991). Additional data were acquired in 1992 in association with J. Peacock's field study on the effects of Bt (Foray 48B) on populations of non-target Lepidoptera in Rockbridge, Co., VA. Foliage samples were conducted post-spray at 1, 7, 24, 48, and 72 hrs. to evaluate a crystal protein analysis procedure to assess the persistence of Bt deposits on foliage. In 1991, the investigator determined that the half-life of inactivation of Bt (DT_{50}) varied from 12-22 hrs., was not related to the amount of initial deposit on foliage, and was inversely dependent on the droplet size (greater inactivation in small droplets.)

GYPCHEK. Over the past several years, we have repeatedly reported that the availability of GYPCHEK is limited by lack of a commercial producer and that the operational use of the product would be greatly enhanced by the development of a commercial formulation that would replace the current tank mix. There have been significant advances in both these areas since the last Steering Committee Meeting.

Over the winter months, Dr. John Podgwaite evaluated 15-20 ready-to-use formulations provided to the Forest Service by American Cyanamid Corp. and another 5-10 formulations provided by Entotech Inc., a subsidiary of NOVO Nordisk. Results of both laboratory and spray tower bioassays indicated that a

few of these formulations performed as well if not better than the standard tank mix that we have been using for several years.

Consequently, one formulation from each supplier was evaluated in a field test near Clarion, PA along with the standard tank mix. GYPCHEK was applied on replicated 30A. blocks at a dosage of 5×10^{11} PIB's twice with three days between treatments. This study was conducted in cooperation with the AIPM Project. Although results are not yet available, observations based on larval reduction and defoliation indicate that both the Entotech and the Standard formulation performed well.

GYPCHEK was also field tested against low-density gypsy moth populations near Clarion, PA using the standard tank mix and dosage (5×10^{11} , applied twice). The purpose of this study was again to evaluate the feasibility of using GYPCHEK against population densities similar to those likely to be encountered in the proposed "Slow the Spread" Project. This is a cooperative study with the AIPM Project.

GYPCHEK was pilot-tested at low dose/low volume (2×10^{11} , applied twice) on a 600A. block near Clarion, PA. This study was replicated in Ontario, Canada in cooperation with John Cunningham (FPMI) and Dick Reardon, AIPM Project coordinator.

Finally, a GYPCHEK formulation containing a commercial brightener called Blankophor (UV absorber) was hydraulically applied on several plots in the George Washington National Forest, and on the Maryland Eastern Shore in cooperation with ARS Scientists. Initial results are encouraging and suggest that the brightener enhances the activity of the virus so that a smaller dose of the virus can be applied with comparable results.

Effect of Bt on non-target Lepidoptera Dr. John Peacock is conducting laboratory and field studies to elucidate the potential impact of Bt applications on select species of non-target Lepidoptera. In the laboratory, bioassays have been completed on over 20 species of Lepidoptera representing several families that are known to occur in eastern oak forests when most spray projects are initiated in the Spring. A field dose of Foray 48B (36BIU) was applied to host foliage using a spray tower simulation. Results suggest that generalizations should not be made about the susceptibility of species to Bt; some early instars were as susceptible to Bt as is the gypsy moth, while other species are not susceptible. The susceptibility of late instar larvae that are present in the early Spring was also highly variable.

In 1991, 10-50 acre plots were established on the Goshen Wildlife Management Area, Rockbridge, Co., VA. Intensive larval sampling was conducted in three strata in order to acquire baseline data on the frequency and abundance of non-target lepidopteran species present in the plots. Several thousand larvae were collected, photographed, and reared to adults in order to facilitate their identification.

This Spring, FORAY 48B was applied to one-half of the plots (1 application; 36 BIU's 96 oz./A.) in order to assess the effects of Bt on non-target species. Deposit analysis of Bt was acquired in cooperation with Dubois and Sundaram, as described earlier. Rearings and identification of lepidopteran species is being facilitated through a cooperative agreement with Prof. David Wagner, University

of Connecticut. As of 20 June, 1992, over 12,000 larvae have been collected including over 1,000 individuals that were collected from beneath burlap bands. More than 34 species of Microlepidoptera and 9 species of Macrolepidoptera have been reared and identified from the study area. Baseline data will also be collected in 1993 to evaluate the effect of the Bt treatment on Lepidoptera one year post-treatment.

Dick Reardon

Reply to: 1350

Date: July 30, 1992

Subject: FY92 Report of Non-Target Impact Subcommittee

To: Jack Barry

I met with Leo Cadogen in Sault Ste Marie, Ontario in April 1992 and we discussed a strategy for bringing together researchers, etc. involved in non-target impact studies in forest ecosystems in both countries. Leo contacted a core group in Canada and I contacted a core group in the US. We asked for their research input as well as willingness to participate as a member of a non-target impact working group. In the Fall, I will travel to FPMI in Sault Ste Marie to meet with the Canadians and Leo will travel to the US to meet with the US group. Following these meetings, Leo and I will organize a working group of members from both countries and this group can act as a central source for reviewing and planning cooperative non-target studies conducted in both countries. Hopefully, and depending upon the availability of funds, the working group can identify and fund cooperative projects.

Also, Steve Munson and I have used numerous data searches thru databases on-line at the University of Utah and West Virginia University in an effort to develop a bibliography of all non-target literature for Diflubenzuron (Dimilin^R) and Bacillus thuringiensis kurstaki as relates to forest ecosystems. The bibliography information is being organized, software developed to access the data using authors, key words, etc. and disks will be available for distribution in Fall 1992. Leo and I will keep the master disks and will be responsible for updating, editing the data.

I might mention that in the US, the Sierra Club and US-EPA are very supportive of this working group and have expressed interest in having responsibilities on the Working Group.

Richard C. Reardon

RICHARD C. REARDON
AIPM Project Leader

RCR/lfc

United States	Forest	Northeastern Area	180 Canfield Street
Department of	Service	State & Private	Morgantown, WV 26505
Agriculture		Forestry	

Reply To: 3400

Date: July 27, 1992

Dr. B.L. Cadogen
FORESTRY CANADA
Forest Pest Management Institute
P.O. Box 490
Sault Ste Marie, Ontario
P6A 5M7

Dear Leo:

The field season is finally winding down and I can finally begin to fulfill some promises I made to you during our meeting in April 1992.


I have searched numerous databases for references concerning impacts of Bacillus thuringiensis kurstaki and Diflubenzuron on non-targets. There were too many references for Bt; therefore, I used additional key words to keep the search within affordable limits. Amy Onken is presently organizing the data and developing software to access the information. The data will be placed onto disks and a copy will be forwarded to you by mid-August.

Also, I have identified some U.S. contacts who might be willing to critique this database as well as to meet and discuss cooperative non-target projects as relate to forest ecosystems. I have not received acceptance letters from all potential members, but include representatives from several universities, Nature Conservancy, Sierra Club, U.S. Forest Service, U.S. National Museum and U.S. Environmental Protection Agency. Hopefully, you had sufficient time to make similar contacts with Canadian researchers?

As we previously discussed, would it be possible for you and I to meet with the respective Canadians and U.S. groups this fall and develop a non-target working group with representatives from both countries? Once this working group is formed, we can schedule a meeting and begin to discuss cooperative efforts in 1993 and beyond.

Thanks for your cooperation.

Sincerely,



RICHARD C. REARDON
AIPM Project Leader

cc: J. Barry ✓
R. Wolfe

RCR/lfc

Reply to: 1580

Date: July 27, 1992

Subject: AIPM Cooperative Projects - 1992

To: Jack Barry

A series of technology development needs were identified at the National Steering Committee for Managing Gypsy Moth and Eastern Defoliation meeting held September 10-11, 1991 in Blacksburg, VA. The AIPM Gypsy Moth Project attempted to address several of these needs through cooperative efforts in FY92. Here is a brief summary of those projects.

2a. AIPM continued efforts to improve application equipment for the aerial application of the gypsy moth pheromone (disparlure) formulated in plastic laminated flakes (Disrupt II) and plastic beads. A contract was awarded to K&K Aircraft to modify the present wing-pod dispensing system for flakes; they subsequently developed a much improved system for larger aircraft (e.g. Twin Beech). The system was evaluated during a series of impact trials and equipment performance and deposit were acceptable. The next step is to pilot test this system in 1993. Also, Harold's Flying Service has submitted a proposal to AIPM for developing a more practical and less expensive system (than the present Hercon System) for dispensing flakes from small fixed-wing aircraft.

Field trials continued using CP nozzles to aerially apply the pheromone impregnated beads. The nozzles performed adequately although we are evaluating formulations in an effort to keep the beads suspended and release pheromone at a slower rate.

3a. In cooperation with Penn State University and Virginia Polytechnic Institute & State University, sequential sampling plans were developed for surveying for gypsy moth egg masses in forested and urban/suburban habitats. A AIPM Technology Transfer Handbook is being prepared and should be available for distribution in September 1992.

3d. A series of cooperative field evaluations were conducted with Cunningham (FPMI-Sault Ste Marie) in Ontario and Podgwaite (FIDR - Hamden, CT) in Pennsylvania to evaluate efficacy associated with various dosages, volumes and formulations of GYPCHEK. American Cyanamid and Entotech prepared commercial formulations for evaluation as part of this effort.

Non-target impact statement report submitted separately to you.

Richard / lfc

RICHARD C. REARDON
AIPM Project Leader

cc: Hertel
Bullard
Cota
McLane

RCR/lfc

United States
Department of
Agriculture

Forest
Service

Northeastern Area
State & Private
Forestry

180 Canfield Street
Morgantown, WV 26505

Reply To: ~ 3400

Date: September 15, 1992

Steve Holmes
Forestry Canada
Science & Sustainable Development
Place Vincent Massey, 21st floor
351 St. Joseph Blvd.
Hull, Quebec
K1A 1G5

Dear Steve:

Thanks for your FAX message of September 3, 1992, which included a list of Canadian researchers who may be interested in participating in a working group on the non-target effects of Bt.

Leo Cadogen and I have discussed the need to schedule a meeting with Canadian scientists (and a follow-up meeting with U.S. scientists) interested in coordinating non-target studies. Since approval for travel between Canada/U.S. is always difficult, the Forest Pest Control Forum would appear to be the best opportunity to meet with Canadian researchers from various geographical locations/organizations without the need for additional travel and a separate meeting. I appreciate your offer to coordinate such a meeting; possibly we (you, me, Leo) could develop an agenda.

An opportunity for a similar meeting in the U.S. might be possible at the Gypsy Moth Research Review scheduled for January 19-22, 1993, in Annapolis, MD. I will need to contact researchers from the western U.S. concerning their availability for this meeting.

We should definitely attempt to form a non-target Bt working group before March 1993 such that we could coordinate 1993/1994 laboratory and field activities in both countries.

Thanks for your cooperation.

Sincerely,



RICHARD C. REARDON
AIPM Project Leader

Noel Schneeberger

NATIONAL STEERING COMMITTEE FOR
GYPSY MOTH AND OTHER EASTERN DEFOLIATORS

August 18-19, 1992
Albuquerque, NM

A REPORT FROM THE NORTHEASTERN AREA

Noel F. Schneeberger
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Abstract

More than 1.1 million acres were treated nationwide for suppression and eradication of gypsy moth infestations (both European and Asian varieties). In the eastern U.S. alone, suppression projects were conducted on 978,057 acres of federal, State and private lands in 10 states. Twice as many acres were treated with Bacillus thuringiensis (B.t.) than with diflubenzuron; much of this being applied undiluted. This report highlights the results of the treatment monitoring program, some NA accomplishments, and recommendations.

NATIONAL STEERING COMMITTEE FOR
GYPSY MOTH AND OTHER EASTERN DEFOLIATORS

A Report from the Northeastern Area

I. Summary of 1992 Projects

This spring saw the treatment of 1,169,630 acres for suppression and eradication of gypsy moth infestations (both European and Asian varieties) nationwide (Table 1). In the eastern U.S. alone, suppression projects totalling 978,057 acres were conducted in 10 states, on 4 National Forests, and on a number of other Federal landownerships including Army Corps of Engineers, National Park Service, Fish and Wildlife Service, and various Department of Defense sites.

Treatments with Bacillus thuringiensis (B.t.) exceeded those with diflubenzuron (DFB) by more than 2 to 1 (676,817 acres versus 288,664 acres). Most of the B.t. treatments were undiluted at 24 BIUs/acre, with some work at 30 and 36 BIUs/acre. The major exception was in Michigan where more than 240,000 acres were treated with 16 BIUs/acre (undiluted), and a minor amount of acreage with 12 BIUs (3,941 acres), 20 BIUs (8,433 acres), and 32 BIUs (873 acres). Diluted B.t. applications were made on the Allegheny National Forest, in Ohio and in Maryland.

A variety of fixed wing and rotary wing aircraft were used; one major distinction being the almost universal use of micronair rotary atomisers for the undiluted B.t. applications. Larger and faster fixed wing aircraft such as Turbine Beech used flat fan nozzles. The primary B.t. products used were the 48 BIU/gallon formulations (Dipel 6AF, Foray 48B, Thuricide 48LV), most commonly applied at 0.5 gpa.

Some exceptions included the Michigan project where Dipel 8AF was applied at 24 oz/acre (12 BIUs) and 32 oz/acre (16 BIUs), and in Maryland where Foray 48B and Dipel 8L were used at rates ranging from 12 to 30 BIUs/acre.

There has also been a major shift of DFB users to the new 4L formulation. DFB was applied at a number of rates ranging from the maximum registered, 0.03 lbs. active ingredient per acre to lesser amounts such as 0.02 lbs. a.i. in MD and 0.015 lbs. a.i. in Pennsylvania. Pennsylvania also evaluated lower dosages of DFB (0.0117, and 0.0078 lbs a.i./acre) on a limited number of acres. The general consensus is that the 4L product has superior handling and mixing characteristics compared to the wettable powder.

Other suppression tactics implemented this year were:

- * Gypsy moth NPV (Gypchek) - 3,647 acres were treated. The bulk of this was conducted by AIPM with lesser amounts being used by the National Park Service and Fish and Wildlife Service.
- * Pheromone flakes - 8,929 acres were treated by AIPM

Results were generally good, although the consensus among state cooperators is that B.t. performance is not up to par with the outstanding results in 1991. Defoliation this year is estimated to be in excess of 2.4 million acres in 15 states (Table 2). The numbers are still being finalized at this time.

Appended to this report are individual reports from the following states: Delaware, Maryland, Michigan, North Carolina, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin.

Lest we forget other defoliators, approximately 7,000 acres were treated this spring with B.t. for controlling hemlock looper on Passamaquaddy Trust lands in Maine. West Virginia reported 4,065 acres of defoliation by a looper complex, and forest tent caterpillar defoliation was reported on an estimated 275,000 acres in New York, Michigan and Minnesota. Other reported defoliators were elm spanworm (PA) and pine looper (NJ).

II. Treatment Monitoring

In 1986, the Treatment Monitoring Data Base (TMDB) was implemented in order to develop information about the effectiveness of gypsy moth suppression projects. The TMDB now contains data spanning 6 years and over 4,000 treatment blocks in 8 states and 2 National Forests. The data base contains information about the treatment areas, insecticides used, the conditions during treatment, aircraft and, of course, project results.

Currently in draft is the second report on suppression effectiveness summarizing two years of TMDB data for 1989-1990. Here is a summary of the results for 1989-1990.

1. Population Reduction (Figure 1)

- * 96 percent of all DFB treated areas resulted in some population reduction.
- * Reducing gypsy moth populations to below 500 em/acre was achieved in 80 percent of the blocks.
- * 69 percent of B.t. resulted in some population reduction.
- * Reducing gypsy moth populations to below 500 em/acre was achieved in 60 percent of all B.t. blocks.
- * Generally better results occurred with higher BIU rates (20 and 24) of application except at higher pre-treatment densities (>2500 em/acre).

2. Foliage Protection (Figure 2)

- * Among all projects there was a 98 percent success rate for DFB.
- * Among all projects there was an 89 percent success rate for B.t. treated blocks.

III. NA Accomplishments in FY92

NA has implemented an ongoing effort to improve project efficacy, increase the awareness of aviation management and safety aspects of spray programs, and to enhance the administration and management of projects in NA. Some of our accomplishments this past year include:

1. FHP and two state cooperators attended FSCBG workshop in Princeton, NJ in March. We Subsequently used AGDISP and FSCBG to evaluate and optimize nozzle placement of rotary atomisers on Bell 47 Soloy and Bell 204 helicopters prior to field characterization.

Recommendations:

- a. Continue improvements to make FSCBG easier to use. A windows environment would be an excellent long term goal.
 - b. Modify FSCBG to allow evaluation of B.t. doses deposited, in terms of IUs of potency per unit area (e.g. cm^2).
 - c. Obtain more wind tunnel test data on drop size distribution of undiluted B.t. through rotary atomisers. This needs to be added to the data library for use in FSCBG. It is sorely lacking at present.
2. FHP cooperated with the Boise Interagency Fire Center (BIFC) to develop a series of one-day Radio Communications Seminars for federal, state and local gypsy moth program managers. Seven seminars were conducted in MI, PA, MD, VA and WV this past winter. More than 200 people attended.

The seminar resulted in an increase in the number of request for use of BIFC radios. Our MD cooperator has requested radios and repeaters to evaluate this fall and winter.

* NA is planning to hold the seminars again this winter.

3. We sent our PA cooperator to the Communications Unit Leader Course in California. Upon return, the cooperator ordered BIFC radios and repeaters to evaluate on a gypsy moth project in one county. The problem he wanted to solve was that state radio frequencies in that part of the state commonly pick up interference from NJ and NY. The BIFC radios and repeaters worked beautifully.

* We are looking at holding a Communications Unit Leaders course in NA this upcoming year.

4. In the area of aviation management and safety, NA-FHP sponsored two S-270 courses - Basic Aviation Operations. Also given was the NA developed (i.e. Bob Adams) Basic Aviation Management and Safety Skills seminar to federal, state and local gypsy moth coordinators. These are well received and will continue on demand.

5. NA-FHP conducted site visits during suppression projects this year. These included visits to DE, MD (4 sites), WV, PA, NJ, MI (5 sites) and WI (2 sites).

* These will continue as a means to evaluate how well our training activities are being integrated in project operations.

6. NA-FHP facilitated a mass purchase of personal protective equipment (PPE) for state cooperators. Nomex flight coveralls and gloves, aviation helmets, fire shirts and work gloves were some of the items we purchased. Costs were deducted from the states' suppression grants. Participating states included NJ, DE, MD, PA and WV.

* NA-FHP will very likely offer this once more in FY93.

7. Technology and Information Transfer. Some of the recent and ongoing vehicles NA-FHP uses to transfer technology and information include:

- a) Gypsy Moth News (3 times/year)
- b) DC-3 Spray Characterization Trials (technical report in DRAFT)
- c) Treatment Monitoring Data Base reports
- d) Annual Suppression and Eradication Project Review Meeting
 - Contracts compendium (office publication).
 - Summary of undiluted B.t. applications and efficacy (office publication)

IV. Needs and recommendations for FY93

On July 20-22, 1992. NA-FHP hosted the 6th Annual Gypsy Suppression and Eradication Project Review Meeting. Attending were State Cooperators and FHP and FPM personnel from NA and R8. One of the major objectives of the meeting is to identify common problems which need attention and to help FHP focus on some immediate needs. Here are some of the highlights from that meeting.

1. Contracts and contracting.

- a. Develop a standard format for contract technical specifications. This will facilitate contract review.
- b. Develop a checklist and timeline for prospective bidders to follow.
- c. Assimilate and compile a list of successful bidders for each project and send to all cooperators by March 31 of each year.

2. Technical Training.

- a. Develop and hold at least two aerial application technology workshops in FY93, targeting state and local gypsy moth program managers.
- b. Hold additional radio communication seminars.
- c. Hold a communications unit leader course in NA.
- d. Conduct other skills training such as in pumps and meters.

3. Aviation Management and Safety.

- a. Continue giving the Basic Aviation Management and Safety (BAMS) seminar on demand.
- b. Hold workshops on helicopter safety such as S-271-Heliport Managers, and S-272 Heliport Managers.
- c. Develop a means to share incident and other fallout information.

4. Other Items.

- a. A need was expressed to hold some training in public meeting management (SDIC/CPO?).
- b. Threatened and Endangered Species. Lake States particularly are having a more difficult time with this issue. Do we need more contact with the Fish and Wildlife Service in other states?
- c. Congested Area Operations. There were still some problems getting congested area plan approvals from FAA, but not as much as in past years.

Many of these items are currently being addressed while others will likely become part of our program of work for FY93.

TABLE 1

ASIAN AND NORTH AMERICAN GYPSY MOTH SUPPRESSION, 1992

State/Site	Dimilin	Bt	Gypchek	Total
-----ASIAN GYPSY MOTH-----				
OREGON AND WASHINGTON				
Eradication	0	124,846 (3X)	0	124,846 (3X)
-----NORTH AMERICAN GYPSY MOTH-----				
DELAWARE				
Cooperative Suppression	17,280	19,375	0	36,655
GEORGIA				
Cooperative Eradication	0	5,250 (2X)	0	5,250 (2X)
MARYLAND				
Cooperative Suppression	24,778	58,676	0	83,454
Aberdeen Proving Ground	0	3,000 (2X)	0	3,000 (2X)
C&O Canal	0	0	30 (2X)	30 (2X)
Eastern Neck NWR	0	0	200 (2X)	200 (2X)
Fort Meade	0	1,128 (2X)	0	1,128 (2X)
National Capital Parks-East	0	60	0	60
Patuxent Wildlife Refuge Center	0	1,797 (2X)	0	1,797 (2X)
MASSACHUSETTS				
Cooperative Suppression	0	2,685	0	2,685
MICHIGAN				
Cooperative Suppression	0	255,301 (2X)	0	255,301 (2X)
Huron-Manistee	0	2,299	0	2,299
NEW JERSEY				
New Jersey Agriculture	0	20,557	0	20,557
New Jersey Forestry	0	4,635	0	4,635
NORTH CAROLINA				
Cooperative Suppression	0	6,688	0	6,688
Cooperative Eradication	500 (2X)	1,406 (2X)	0	1,906 (2X)
OHIO				
Cooperative Suppression	3,901	1,610	0	5,511
PENNSYLVANIA				
Cooperative Suppression	85,121	118,673	0	203,794
Allegheny	0	23,133 (2X)	0	23,133 (2X)
Cowanesque Lake	0	119	0	119
Grey Towers	0	45	0	45
Shenango Lake	0	112	0	112

TABLE 1 (Continued)

ASIAN AND NORTH AMERICAN GYPSY MOTH SUPPRESSION, 1992-CONTINUED

State/Site	Dimilin	Bt	Gypchek	Total
PENNSYLVANIA - CONTINUED				
Tioga/Hammond Lake	0	464	0	464
Tionesta Dam	0	169	0	169
Youghiogheny Lake	0	58	0	58
TENNESSEE				
Cooperative Eradication	1,000 (2X)	2,000 (2X)	0	3,000 (2X)
UTAH				
Cooperative Eradication	0	15,718 (3X)	0	15,718 (3X)
VIRGINIA				
Cooperative Suppression	64,264	43,185	0	107,449
AIPM Project	39,520	47,028	5,919 (2X)*	92,467 (2X)*
George Washington NF ***	60	2,130	97	2,287
Blue Ridge Parkway	78	1,077	149 (2X)	1,304 (2X)
Jefferson NF	0	0	343 (2X)	343 (2X)
Rockingham County	0	0	915 (2X)	915 (2X)
Shenandoah NP	402	75	0	477
Carroll County Eradication	0	5,280	0	5,280
Fort Belvoir	3,355	80	0	3,435
Frederick/Spotsylvania NB	0	292 (2X)	0	292 (2X)
Mannassas NBF Park	0	283	0	283
Prince William Forest	0	340	353	693
Quantico Marine Base	4,082	1,480	0	5,562
Shenandoah NP	863	0	0	863
Warrenton Training Camp	378	0	0	378
WISCONSIN				
Eradication	0	40,853 (3X)	0	40,853 (3X)
WEST VIRGINIA				
Cooperative Suppression	26,516	3,408	0	29,924
AIPM Project (S&PF)	18,066	39,574	3,650**	61,290**
Monongahela NF	0	9,977	920 (2X)*	10,897 (2X)*
WVDA Regulatory	0	2,024	0	2,024
GRAND TOTALS	290,164	866,890	12,576	1,169,630

(2X) Double applications on some or all of the acreages shown.

(3X) Triple applications on all of the acreages shown.

* Includes pheromone flakes (Virginia AIPM Project: 4,829; West Virginia Monongahela NF: 450)

** Pheromone flakes only (no Gypchek included)

*** Includes AIPM acres

Note: Data obtained from the National Pest Suppression Tracking System, Forest Health Protection, Morgantown, WV, July 21, 1994.

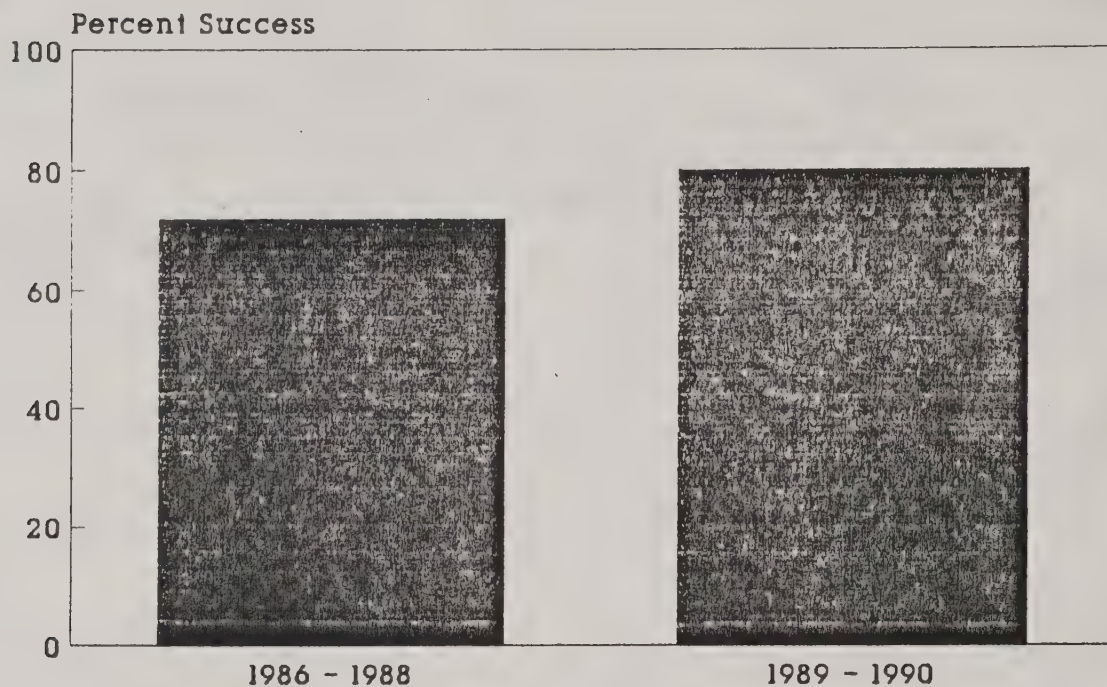
Table 2.--1992 Defoliation Estimates (as of 8/31/92)

STATE	NO. OF ACRES DEFOLIATED
--NORTH AMERICAN GYPSY MOTH--	
DELAWARE	4,943
CONNECTICUT	31,637
MASSACHUSETTS	500,000 *
MARYLAND	38,704
MAINE	300,000 *
MICHIGAN	400,000 *
NEW HAMPSHIRE	175,000 *
NEW JERSEY	165,960
NEW YORK	50,000 *
OHIO	1,105 *
PENNSYLVANIA	100,000 *
RHODE ISLAND	0
VERMONT	1,000 *
VIRGINIA	600,000 *
WEST VIRGINIA	67,508
TOTAL	2,435,857
--FOREST TENT CATERPILLAR--	
MICHIGAN/MINNESOTA	200,000 *
NEW YORK	75,000 *
TOTAL	275,000
--LOOPER--	
WEST VIRGINIA	4,065
--ELM SPANWORM--	
PENNSYLVANIA	2,000 *

* ESTIMATED ACREAGE

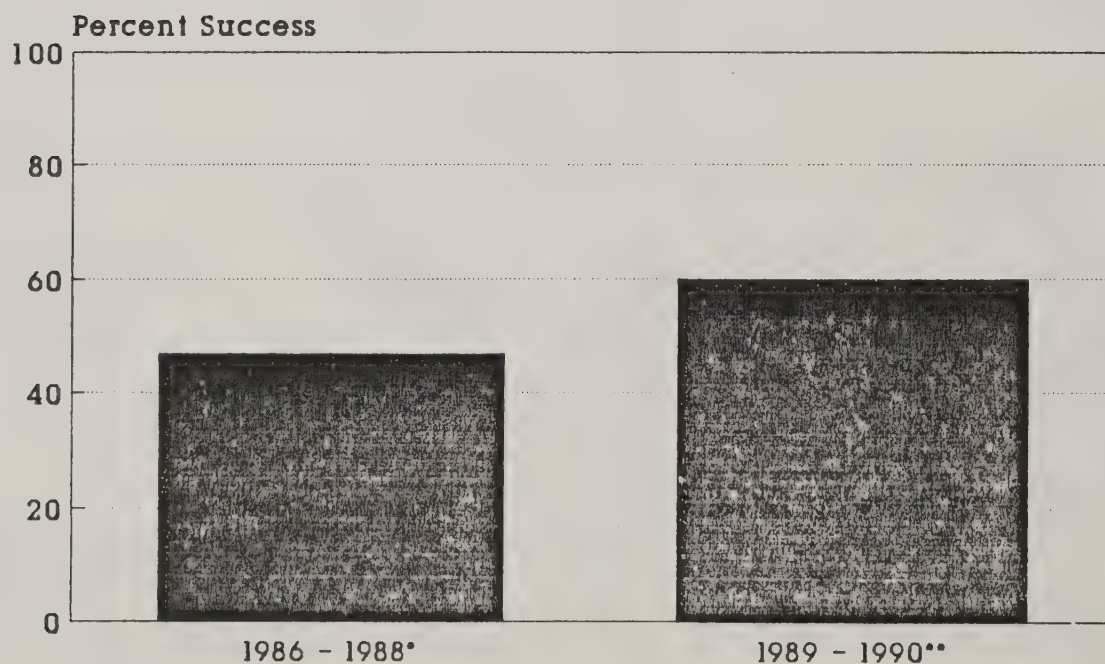
FIGURE 1

SUCCESS BASED UPON POPULATION REDUCTION DIMILIN



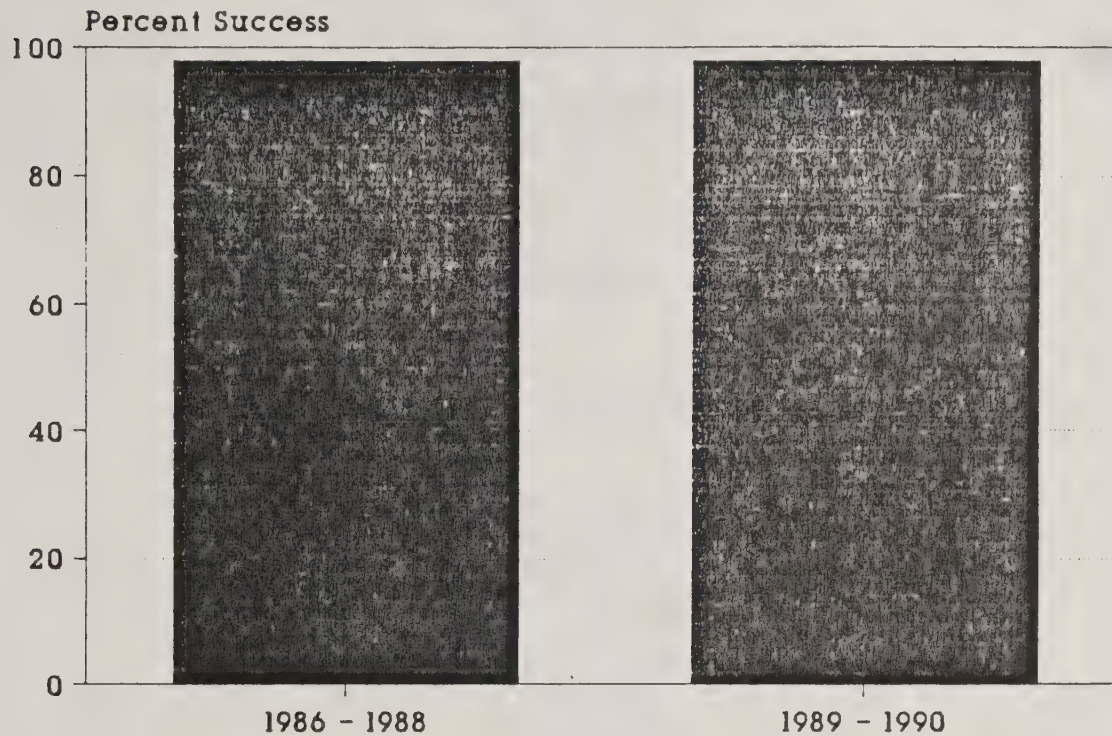
Success is defined as having < 500 egg masses per acre after treatment.

SUCCESS BASED UPON POPULATION REDUCTION BT



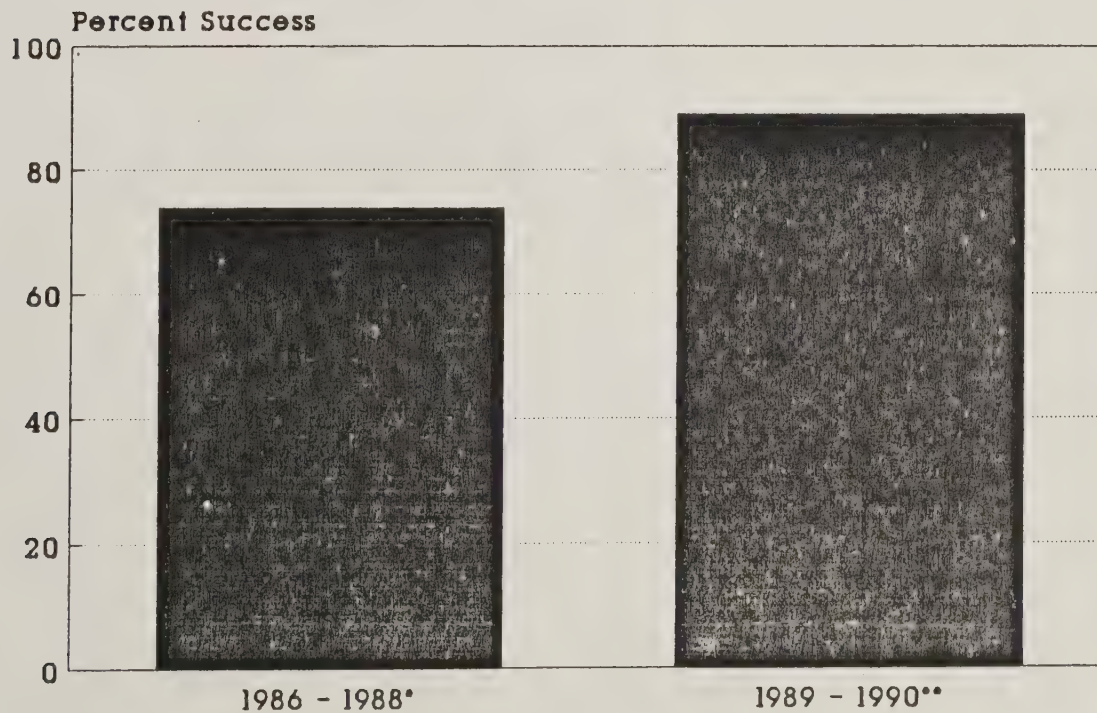
* Dipel only; ** All Bt products
Success is defined as having < 500 egg masses per acre after treatment.

SUCCESS BASED UPON DEFOLIATION - DIMILIN



Success is defined as reducing defoliation to below 30 percent.

SUCCESS BASED UPON DEFOLIATION - BT



* Dipel only; ** All Bt products
Success is defined as reducing defoliation to below 30 percent.

REPORT FROM NORTHEASTERN AREA

APPENDIX

STATE REPORTS FROM:

DELAWARE
MARYLAND
MICHIGAN
NORTH CAROLINA
OHIO
PENNSYLVANIA
VIRGINIA
WEST VIRGINIA
WISCONSIN



STATE OF DELAWARE
DEPARTMENT OF AGRICULTURE
DIVISION OF PROMOTION & PRODUCTION SUPPORT
2320 SOUTH DUPONT HIGHWAY
DOVER, DELAWARE 19901

TELEPHONE: (302) 739 - 4811

FAX: (302) 697 - 6287

STATE OF DELAWARE

1992 GYPSY MOTH SUPPRESSION PROGRAM

FEDERAL/STATE COOPERATORS MEETING

Cacapon State Park, WV July 20-22, 1992

Donald A. Eggen, Plant Industry Supervisor

SPRAY PROGRAM

A total of 36,655 acres were treated in Delaware in 1992 at a total cost of \$305,917.85. Application began on May 1 and was completed on May 11. Foliage expansion on the oaks ranged from 30 to 40%. Caterpillars were in the first and second instars. Due to state budget cutbacks, 4,827 acres that qualified for treatment were dropped from the spray program. The spray blocks dropped from the program were private lands without a coordinator and with the lowest egg mass densities.

Dimilin 4L was applied to 17,280 acres at the rate of one fluid ounce (0.5 oz AI) per acre in one gallon of water. Two Thrush Commanders from contractor K & K Aircraft, Inc. were used to spray Dimilin at a cost of \$7.22 per acre.

Thuricide 48 LV was applied undiluted to 19,375 acres at the rate of 24 BIU/64 oz/acre. Two Bell 206BEIII Jet Ranger Helicopters with rotary atomizers from Summit Helicopters, Inc. were used to spray Thuricide at a cost of \$9.35 per acre.

RESULTS

An aerial survey for defoliation was conducted by the Delaware Department of Agriculture in late June. Refer to the attached tables for the results. We have not prepared a state map, but one will be available at the Gypsy Moth Review meeting in November. A total of 4,943 acres were defoliated this year, which is down from the 13,475 acres defoliated in 1991. However, defoliation within spray blocks is up this year compared to previous years. In 1990 and 1991 less than 1% of the spray acreage suffered some level of defoliation. This year 3.4% (1,251 acres) of the acres treated had some defoliation that was mapped during the aerial defoliation survey. The cold day and night temperatures in early May might have caused the young larvae to not feed. In addition, on May 7-8 over 2.5" of rain fell on southern Delaware, where the majority of the spray blocks were located. Some of the defoliated acreage is due to pilot skips (acreage not available yet).



Every year since the mid-1980's Delaware has always been able to spray all qualified areas with egg mass densities exceeding 250 em/acre. This year and in 1991 we needed additional state funding, which was not approved. Delaware's policy of initiating treatment at the 250 em/acre threshold has resulted in relatively few acres being defoliated over the past few years, but that is not the case since 1991. As a result we have implemented a Coordinator/Cost-Sharing program similar to West Virginia's program. This program is outlined in the July 1992 issue of the Delaware Gypsy Moth Newsletter.

For 1993, coordinators must sign-up for fall surveys by September 15 by submitting a topographic map along with the name of the person who will be the coordinator. We will only survey state and county lands and those private lands that have a coordinator. We have many coordinators already, but many are slow in signing up for 1993. We will have a public meeting on August 19 to let new and previous coordinators sign-up for surveys, collect literature to hand out to their neighbors, and ask questions about the program.

PROBLEMS

A contract battle between two applicators occurred this year, in part due to poor wording in our aerial spray contract and mistakes made by the Delaware Division of Purchasing. This is why I think it is necessary that contracts should be organized and simplified and include the technical, safety and legal requirements in a well structured contract. Some standardization among the states may be useful in developing contracts that will help applicators bid properly and allow them to find information more easily.

We had a problem calibrating one helicopter before the start of the program. Cold mornings made the Thuricide very thick, and the spray system on the helicopter was new. We had to reduce the spray swath to 75', because the flow rate was not consistent with a 100' spray swath. During the spray operations, after the system had been used, the pressure stabilized and there were no more problems. On the last day of spraying this helicopter developed mechanical problems and could not fly. The second helicopter had finished its blocks, so we just transferred that aircraft to the remaining spray blocks.

History of the Delaware Gypsy Moth Program 1979 - 1992

Year	Acres Treated			Treated Acres Defoliated	Total Acres Defoliated Statewide
	B.t.	Dimilin	Total		
1979	0	0	0	0	10
1980	0	0	200 ¹	0	0
1981	0	0	500 ²	NA	260
1982	355 ³	0	355	NA	1,425
1983	0	1,076	1,076	NA	2,992
1984	29,120	0	29,120	6,500	14,203
1985	58,427 ⁴	0	58,427	3,622	5,144
1986	42,071	16,722	58,793	1,569	3,118
1987	16,159	35,352	51,511	902	2,530
1988	13,098	30,297	43,395	97	791
1989	14,185	25,515	39,700	80	1,888
1990	15,256	42,462 ⁵	57,718	218	3,790
1991	6,219	35,353	41,572 ⁶	277	13,475
1992	19,375	17,280	36,655 ⁷	1,251	4,943

¹Sevin 4-oil applied to 200 ac by Winterthur Gardens to their property

²Sevin 4-oil applied to 200 ac in Winterthur Gardens and 50 ac in Westover Hills by helicopter (privately sprayed); & approximately 250 ac using a ground mist applicator along Route 13 between Dover & St. Georges bridge (USDA/APHIS).

³Two applications made on 355 acres

⁴Two applications made on 8,800 acres

⁵Two applications made on 24 acres

⁶An additional 20,984 acres were not sprayed due to budget limitations

⁷An additional 4,827 acres were not sprayed due to budget limitations

1992 Delaware Gypsy Moth Suppression Program Acreage Meeting
Minimum Spray Block Criteria

	Bt Proposed Acreage	Dimilin Proposed Acreage	Total Qualifying Acreage
State Lands	1,821	2,473	4,294 ^a
Coordinated Private Lands	7,991	625	8,616 ^a
Non-Coordinated Private Lands Adjacent to State Lands	1,480	1,394	2,874 ^a
Non-Coordinated Private Lands	7,899	12,363	20,262 ^a
Coordinated Private Lands (Cost-Shared)	184 ^b	425 ^c	609
Non-Coordinated Private Lands (Not sprayed)	2,000	2,827	4,827
Total Qualifying Acreage	21,375	20,107	41,482
Total Spray Acreage	19,375	17,280	36,655

^aThis acreage did not require landowner cost-sharing.
^bCost to the landowner was \$4.68/acre for BT.
^cCost to the landowner was \$3.61/acre for Dimilin.

1992 Delaware Gypsy Moth Defoliation

COUNTY	Defoliated Acres			TOTAL
	LIGHT <30%	MODERATE 30-60%	HEAVY >60%	
New Castle	84	23	32	139
Kent	732	654	181	1,567
Sussex	1,028	1,663	546	3,237
State Total	1,844	2,340	759	4,943

A total of 36,655 acres were sprayed in 1992, and 1,251 treated acres (3.4%) had measurable defoliation.

1992 DELAWARE GYPSY MOTH DEFOLIATION WITHIN TREATMENT BLOCKS

INSECTICIDE	ACREAGE TREATED	<u>Defoliated Acres</u>			TOTAL
		LIGHT <30%	MODERATE 30-60%	HEAVY >60%	
Thuricide 48LV	19,375	308	360	109	777
Dimilin 4L	17,280	63	336	75	474
Total	36,655	371	696	184	1,251

18 of 87 spray blocks treated with Thuricide 48LV and 9 of 76 blocks treated with Dimilin 4L had some areas defoliated within the block that exceeded 20% defoliation.

1992 Summary of Gypsy Moth Egg Mass Densities in Delaware Suppression Treatment Blocks

Insecticide	Average Prespray Egg Mass Density (egg masses/acre \pm SE)	Number of Spray Blocks (n)	Range of Average Spray Block Egg Mass Densities
Thuricide 48 LV	3,405 \pm 787	87	280 to 60,000
Dimilin 4L	4,592 \pm 678	76	260 to 36,000

**1992 SUMMARY OF THE DELAWARE
GYPSY MOTH AERIAL SPRAY PROGRAM**

Insecticide	Aircraft	Nozzles/Rot. Atomizers	Acreage	Dose/ac	Volume/ac	AI or BIU/ac
Dimilin 4L	Thrush Commanders(2)	22 - 8010s 100' swath 110 mph 22.2 gpm	17,280	1 fl oz	128 oz	0.5 oz
Thuricide 48 LV	Bell 206BIII Jet Ranger	4 - AU5000s VRU = 11 35° angle 30 psi 80 mph 100' swath 8.1 gpm	13,219	64 oz	64 oz	24 BIU
Thuricide 48 LV	Bell 206BEIII Jet Ranger	4 - AU5000s VRU = 9 35° angle 30 psi 80 mph 75' swath 6.1 gpm	6,156	64 oz	64 oz	24 BIU

MARYLAND DEPARTMENT OF AGRICULTURE
FOREST PEST MANAGEMENT SECTION
1992 COOPERATIVE SUPPRESSION REPORT

Maryland's 1991 Gypsy Moth Cooperative Suppression Season and subsequent defoliation initiated a reverse trend in the state's gypsy moth population from previous years. Prior to 1991, each successive year surpassed the previous year's totals in state suppression acres and defoliation. The 1991 survey season estimated reductions in population levels and consequently in the total amount of acres treated by the state from a high of 187,723 acres in 1990 to 149,085 in 1991 (a reduction of approximately 20%). Defoliation levels also decreased from a state high of 133,062 in 1990 to 75,197 acres in 1991 (a reduction of approximately 43%). Four counties directed their own suppression programs in concert, but separately from the state project. One county declined to participate in the suppression program due to fiscal problems. One county, Calvert did not have enough of a gypsy moth population to propose aerial suppression activities.

Egg mass surveys conducted in the fall of 1991 demonstrated a continuance of declining populations in many areas of the state. Many counties which traditionally had harbored high gypsy moth populations witnessed populations on the verge of collapse, while counties which were experiencing their initial establishment of the gypsy moth saw classic egg mass population expansions.

Calendar year 1992 began in Maryland as a year of uncertainty. Maryland, as other states, counties and municipalities faced tough economic decisions as a result of a sluggish recession. Throughout the fiscal year, state departments and employees were asked to give concessions in order to balance the state's budget which was sorely inadequate due to reduced revenues. State legislative and budgetary personnel continued to cut funds to counties through out the year. Unfortunately, every time the state government cut funds to the counties, the counties in turn were forced to make difficult decisions in what to fund and what to cut.

In April, as the state initiated another round of budget cuts, a few Maryland counties had not communicated with The Department of Agriculture on their intentions to participate in the Cooperative Suppression Project. Eventually, four counties would decide not to participate in the cooperative suppression program, many participating counties reduced their contribution to the program and only two counties conducted their own separate gypsy moth suppression projects. In an effort to maintain previous successful suppression efforts, we suggested home owner cost share in proposed spray blocks to county governments. We assisted responsive counties in the billing of property owners. This allowed "user fees" to offset the county government's financial withdrawal from the program.

Four Invitations For Bid (IFB) were registered for contractual bidding: Downstown Airport, Inc. of Vineland, N.J. was awarded contract 119; Bob Ruhe Ag Service of Lepisic, Ohio

was awarded contracts 120 & 122; and Helicopter Applicators, Inc. of Frederick, Maryland was awarded contract 121. A total of 14 aircraft, fixed and rotary wing were active in the spray program.

Weatherwise, Maryland experienced a mild winter in 1992, however spring lagged and cool temperatures delayed initial spray flights by at least a week. One county, Calvert still was not included in a proposed state suppression project due to the low egg mass counts. All the other 23 districts have been infested to some degree. The state operation began on May 4 on the Eastern Shore and ended on May 27 in Western Maryland. Many operations were hampered by environmental conditions such as fog which would not lift until mid or late morning, wind and rain. Overall the suppression spray operation took 21 days. A total of 84,479 acres were sprayed statewide in 438 spray blocks with 25,997 acres sprayed with dimilin (dfb), 21,007 acres sprayed with Foray 48B and 37,475 acres sprayed with Dipel 8L. This year dimilin was sprayed at a rate of 0.2 ounces of Active Ingredient per acre as opposed to previous years where the rate was 0.25. Bacillus thuringiensis was dispersed in rates ranging from 12 to 30 BIU's depending on the population situation. 0.

1992 suppression season began a time of illness for MDA employees: One regional entomologist had problems focusing his eyes during an aerial observation flight, was relieved by another entomologist and subsequently medical attention; The entomologist on the Eastern Shore was bitten by an unknown species of spider and had to seek medical help to reduce the swelling in his hand; A research entomologist from Beltsville contracted Lyme disease and is currently under medication; The senior secretary in the Annapolis office developed pneumonia and is currently under medical care.

1992 saw and increased interest from the FAA in our proposed spray blocks in "congested areas" and they did refuse to accept 3 blocks with respect to type of aircraft in Frederick County, Maryland. The blocks or flight approaches were altered with a minimum of aggravation. However, property owners whose properties were removed because of FAA regulations were very unhappy.

MDA received the usual calls about waking citizens at 7:00 am or that the aircraft were flying too low. We also received a complaint about spraying near children at a bus stop. The complainant got his name and provided misinformation to a local paper. One Montgomery County woman was irate because she got a spray notice in March and thought she was to be sprayed then. She felt that MDA personnel should go to every house in a proposed spray block the evening before an area is sprayed to warn residents and did not like the idea of calling our toll-free number to get information. Another gentleman from Charles County insisted he was missed by the spray plane. Two weeks later and inspection of his property indicated no defoliation and a lot of dead caterpillars. One ironic call came from a woman who had objected to the state program and found out her neighbors were spraying insecticides anyway. In general complaining calls were few.

We received several calls by citizens and MDA personnel

describing classic virus or fungus symptoms in several areas of the state. Samples were taken by MDA personnel and they are being analyzed. One frantic caller complained that the caterpillars were hanging from her trees and when she touched them, they exploded.

We reported one aircraft incident. A ground observation entomologist noticed a trail of black smoke coming from the observation aircraft as it took off from the landing zone. The aircraft was immediately contacted by radio. The observation craft pilot stated he had changed the oil in the engine on the previous day, his instruments were reading within their limits and he felt that the smoke may have been due to spill oil on the engine. After circling the landing zone, the smoke disappeared, the gauges continued to read within the normal range and the operation continued as planned.

Several proposed spray block areas were home to defoliators other than the gypsy moth. Many areas of the state suffered heavy defoliation due to a looper complex. In some instances the loopers had defoliated the oak leaves before the gypsy moth. Other defoliators included Eastern Tent Caterpillar (Malacosoma americanum), Forest Tent Caterpillar (Malacosoma disstria), and the Buck Moth (Hemileuca maia). In some blocks up to three of these defoliating species joined the gypsy moth in defoliation.

Gypsy moth defoliation was originally predicted to be less than previous years due to the trend of collapsing populations in many areas of the state. A total of 38,694 acres of moderate or high defoliation was recorded. This figure represents approximately one half the 75,197 acres of defoliation reported in 1991. However, while many areas which traditionally experienced high gypsy moth defoliation reported no defoliation 37,056 acres (96%) of the state total was described in 7 counties on the Eastern Shore. The gypsy moth only recently become established in these Eastern Shore counties.

Michigan Cooperative Suppression Program

1992 OPERATIONAL PROGRAM

Participants: 22 counties; MDNR

Contractors: 7

Aircraft: 6 helicopters; 21 fixed wing

Dates: 19 May through 2 June

Acres: 255,301

Method: all rates applied undiluted with rotary atomizers

Materials:

	BIU/Acre	Acres Treated
Dipel 8AF	12	3,941
	16	51,290
	32	873
		56,104
Foray 48B	16	190,764
	20	8,433
		199,197

Aircraft were calibrated 4-7 May with Friday the 8th as a makeup day. The program began a few days later than last year but was down only one day due to weather. Most of the program, however, was plagued by freezing mornings. Several of the days operations began at temperature below 40 degrees F. Tom Schmidt of Novo Lab was on hand and provided recommendations for these unusual conditions.

Both materials used flowed well under all operational weather conditions. Post treatment evaluations are now being conducted. Results should be available by early September.

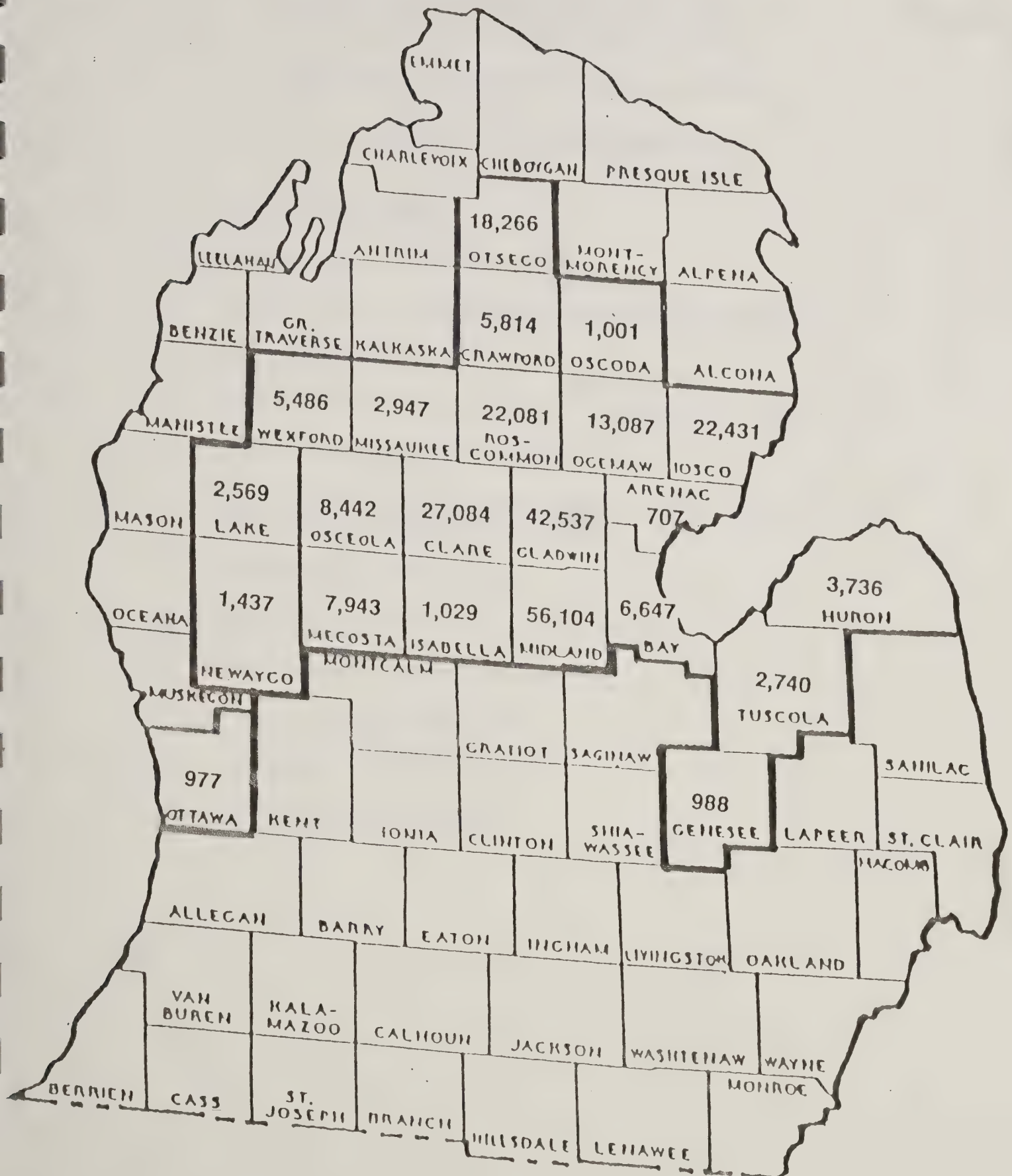
Only one incident occurred. A plane was forced down due to lack of fuel. An informal hearing was conducted by MDA with the contractor and coordinator to determine the cause of this pilot error. FAA was notified.

Four reports were received from National Forest Service personnel regarding fly-overs of sensitive bird nesting areas. They also raised this concern with Fish & Wildlife. After talking with FS and checking the specific locations of concern, it was apparent that these fly-overs were for private gypsy moth work. Both agencies are interested in taking some action against the applicators even though F&W considers these locations proprietary information and has not made it available to applicators. MDA is working with F&W, FS, and applicators to resolve this issue and avoid future fly-overs.

The program ran almost without incident this year. The unique weather conditions of several frosts has produced a wide variance in larval instars that has persisted throughout the entire feeding period. Effects of frosts to kill up to two leaf flushes and gypsy moth eating a third will likely have dramatic effects in some areas. The frost seems to also had an adverse effect on GM larvae with wilt of early instars common. The addition of a prolonged drought has only exacerbated the situation.

20 July 1992

Michigan Cooperative Gypsy Moth Suppression Program 1992 Treated Acres



Michigan Department of Agriculture
Pesticide and Plant Pest Management Division
1992 Gypsy Moth Suppression Program

MDA Block Advisor's Reference Folder

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1. Daily Acreage Report
2. County Maps of Treatment Blocks
3. Spray Block Summary Sheets (counties in assigned block)
4. Treatment Staff
5. Treatment Inspection Form (ground inspection and monitoring)
6. Aerial Observation and Monitoring Form
7. Spray Aircraft Set-up Summary Sheet (aircraft calibration results-swath widths and air speed)
8. CropHawk Operations Manual
9. MDA/Counties Radio Channel and Frequency
10. Label samples (Insecticide & MSDS)
11. Project Work and Safety Plan
12. Emergency Telephone Numbers
13. (RFQ) Request for Quotation

1992 GYPSY MOTH SPRAY PROGRAM
FOR NORTH CAROLINA

Acres Receiving Aerial Treatment:

1406 (2X) with Bt
500 (2X) with Dimilin
6688 (1X) with Bt
10,500 Acres Total

Acres Receiving Ground Treatment:

7 (2X) with Dimilin
15 (2X) with Bt
10 (1X) with Bt
54 Acres Total

Treatment Period: 4/20 - 6/01/92

Treatment Product: Thuricide 48 LV
Dimilin 25W

Aerial Application Contractor: K & K Aircraft, Inc.
Bridgewater, VA

Application Rate:

Undiluted Bt -- (1X)sites = 80 oz/Ac or 30 BIU/Ac.
(2X)sites = 64 oz/Ac or 24 BIU/Ac.
Dimilin -- (2X)sites = 2 oz/Ac mixed at 1 gal/Ac.

Aircraft Used:

(1) Turbine Twin Beech

Spray System:

Undiluted Bt at 24 BIU/Ac = (27) 8006 FF at 135° forward
Undiluted Bt at 30 BIU/Ac = (33) 8006 FF at 135° forward
Dimilin Mix at 1 Gal/Ac = (17) 8020 FF at 135° forward

Ground Applications:

Mist Blower - Mix rate = 10 gal/Ac.
Hydraulic Sprayer - Mix rate = 100 gal/Ac.

1992 GYPSY MOTH SPRAY PROGRAM
FOR NORTH CAROLINA

Acres Receiving Aerial Treatment:

1406 (2X) with Bt
500 (2X) with Dimilin
6688 (1X) with Bt
10,500 Acres Total

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Ground Applications:

Mist Blower - Mix rate = 10 gal/Ac.
Hydraulic Sprayer - Mix rate = 100 gal/Ac.

1992 NORTH CAROLINA GYPSY MOTH PROGRAM

AERIAL TREATMENT SITES

- | | | |
|----|---------------------------------------|--|
| 1) | Winton
(Gates County) | 250 acres - Bt (two applications) |
| 2) | Mitch Ridge
(Hertford County) | 350 acres - Bt (two applications) |
| 3) | Lewiston-Woodville
(Bertie County) | 281 acres - Bt (two applications) |
| 4) | Ferry Ridges
(Hertford County) | 2,040 acres - Bt (one application) |
| 5) | Severn
(Northampton County) | 1,000 acres - Bt (one application) |
| 6) | Old Trap
(Camden County) | 3,648 acres - Bt (one application) |
| 7) | Big Flats Church
(Ashe County) | 1,025 acres --- 525 acres Bt
--- 500 acres Dimilin
(two applications each) |

GROUND TREATMENT SITES

- | | | |
|----|--------------------------------------|--------------------------------------|
| 1) | 13 Catch Site
(Cumberland County) | 3 acres - Dimilin (two applications) |
| 2) | Sampson Co. Site | 4 acres - Dimilin (two applications) |
| 3) | Currituck County
Public Rest Area | 10 acres - Bt (two applications) |
| 4) | Old Trap
(Camden County) | 10 acres - Bt (one application) |
| 5) | Atlantic Veneer
(Carteret County) | 5 acres - Bt (two application) |

Ohio Suppression Summary 1992

Allen Baumgard
Gypsy Moth Program Manager

The Ohio Gypsy Moth Suppression activities in 1992 were larger than in 1991 by several thousand acres (1991 - 1200 acres vs. 1993 - 5500 acres).

We again used the "Open House" at the county level meetings. We set up our displays and invited the public to come at their leisure between specified hours and days. The area was manned by Ohio Department of Agriculture, Extension, and some Forestry personnel. This format has helped take a lot of the emotionalism out of the discussions and facts have become more of an issue.

We have had two counties put together county advisory groups to help direct the program in their particular county. This has also helped take some of the emotionalism out of process.

We have strived to get as many people involved in the decision making as possible. Before, we were thought of as Big Brother coming in to force something on them. Now they feel they are part of the process and are asking for our help. Things seem to be going much smoother than in the past few years. In 1992, we didn't have any big people problems.

In Ohio, we still have the Ohio Gypsy Moth Management Council which meets biannually. This group has tried to pull together the top people, in Ohio, in several gypsy moth related fields. We have people from all angles of the gypsy moth problem together to share information and convey their opinions.

We again used a State helicopter and pilot to do our spraying. I think this will be our last year we will be able to use State aircraft exclusively. In 1993, we will start up the dreaded contracting out route. We are anticipating well over 6,000 acres of spray activities for 1993, with 6,000 being our break off point for the State helicopter.

The spraying activities went very well this year. We had beautiful weather all but on one Saturday and wind problems only one day.

We started treatments on May 12 and finished on May 27. All of our treatments were put on with a Hiller 12E. Our rates were 1/2 oz per acre of active ingredient, mixed in a gallon of water, for the Dimilin (used both 25W and 4L) and 24 BIU's per acre of Foray 48B diluted with 1/2 gallon of water. I was very happy with the 4L formulation that I doubt I ever buy the 25W again.

COUNTY	ACRES SPRAYED	PESTICIDE USED
Ashtabula	2,687 730	Dimilin B.t.
Columbiana	90	Dimilin
Geauga	65	B.t.
Lake	494 815	Dimilin B.t.
Trumbull	630	Dimilin
TOTAL Dimilin	3,901	
TOTAL B.t.	1,610	
TOTAL ACRES	5,511	

The only real problems we had this year were with the helicopter. It had mechanical problems four times and we subsequently lost four days of spraying. It had various problems :

- 1) harmonic balance weight broke off and went through the fan
- 2) lost a cylinder when a valve broke off inside
- 3) Generator quit functioning
- 4) primer fuel pump went bad

One small problem we had were with the radios we were using. They were borrowed from USDA, APHIS and only some of them worked, part of the time. We will have to rectify this situation before next year.

We have just completed our aerial survey and our still compiling the results but early indications suggest our totals for defoliation will surpass last years by about triple ('91 - 345ac '93 - 1000+). Our spray blocks all looked good except one site where we used B.t. and had moderate to high egg mass counts before spraying.

We haven't received as many calls this year from the public about gypsy defoliation as neither has the extension offices. This is due to either less total number of defoliated areas or better public knowledge of the gypsy moth or both.

Commonwealth of Pennsylvania
Department of Environmental Resources
Office of Parks and Forestry
Division of Forest Pest Management
34 Airport Drive
Middletown, PA 17057-5021

1992 GYPSY MOTH SUPPRESSION PROJECT

Spray operations in Pennsylvania had a belated start in 1992 because of an unusually cold spring. Operations began on May 10 and were completed on June 2.

All told during that period, there were only four days during which there was no spraying conducted anywhere in the state. This resulted in 20 spray days to do 204,761 acres, an average of 10,238 acres per day. From the reports received, all of the applications were timed properly and the results look good. Only two major retreatments had to be conducted, 150 acres in Lackawanna County and 55 acres in Fulton County--all private Bt acreage.

A total of 17 spray aircraft (12 helicopter and five fixed winged) were used in the six contracts. A breakdown of these by contract is given below. Of the 204,761 acres, 119,640 acres were sprayed with Bt and the balance, 85,121 acres, was treated with DFB. Two formulations of Bt, Foray 48B and Thuricide 48LV, were used each at 24 BIU or 36 BIU per acre. Likewise, two formulations of DFB were used--Dimilin 4L and Dimilin 25W. The following is a detailed breakdown of the acreage by insecticide formulations and rates:

Bt - Foray 48B, 24 BIU, 64 ounces/acre undiluted (30,507 acres)
 36 BIU, 96 ounces/acre undiluted (59,056 acres)
 Thuricide 48LV, 24 BIU, 64 ounces/acre undiluted (25,782 acres)
 36 BIU, 96 ounces/acre undiluted (4,295 acres)

DFB - Dimilin 4L, .25 ounce AI, 1 gallon/acre diluted (44,843 acres)
 .1875 ounce AI, 1 gallon/acre diluted (430 acres)
 .125 ounce AI, 1 gallon/acre diluted (470 acres)
 Dimilin 25W, .25 ounce AI, 1 gallon/acre diluted (37,943 acres)
 .1875 ounce AI, 1 gallon/acre diluted (985 acres)
 .125 ounce AI, 1 gallon/acre diluted (450 acres)

Other than the usual landowner complaints, there were few problems. We did have an 80-gallon Dimilin spill on the tarmac at the Clearfield Airport which was immediately cleaned up, and the chief pilot for one of the contractors fell from the back of a nurse truck, broke his wrist, and bruised a few other parts.

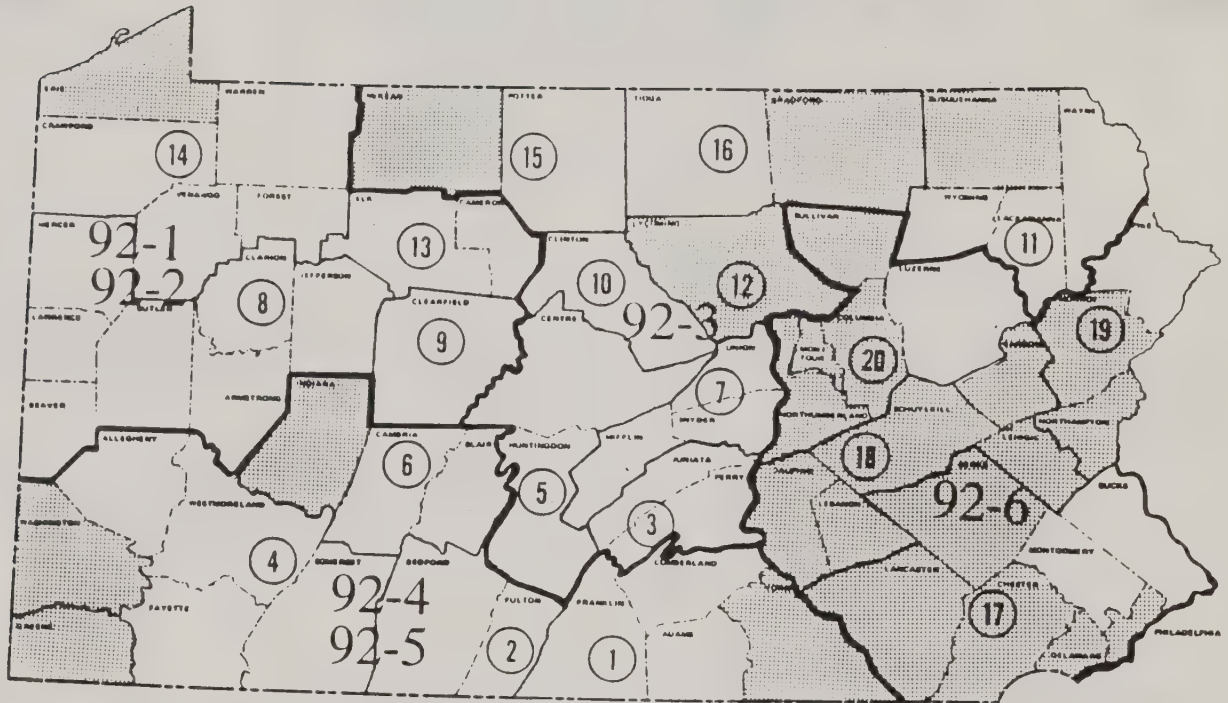
Three special projects were conducted during the course of the 1992 project. The first of these involved low-dosage applications of DFB (0.1875 ounce AI and 0.125 ounce AI) on State Forest land in Clearfield and Centre Counties. Initial observations indicate that even the lowest dosage is working as far as foliage protection is concerned.

The second project was designed to evaluate the use of alternative navigational aids by the spray pilot. Certain residential blocks in Centre County were treated using the standard combination of topographic maps with helium-filled balloons marking reference points on the ground while others were treated using the maps without the balloons. The same pilot and aircraft were used to treat additional residential blocks in Tioga County but with aerial photographs with and without balloons. Comparisons will be made of the time involved and the accuracy of the treatments to determine which method is most efficient and cost effective.

The third project investigated the utility of using radio frequencies separate from the Bureau of Forestry system for communication within a contract area. A series of frequencies and several radio repeaters were borrowed from the USDA Forest Service fire cache system in Boise, Idaho, and utilized while spraying in Pike County. Communications were greatly improved with the system, eliminating the extraneous transmissions which originate within the Bureau of Forestry system and with users in neighboring states who share the Bureau of Forestry frequencies.

The two associated tables provide a breakdown of the acreage treated by ownership and insecticide and the costs incurred for each contract for insecticide and application. A detailed report on the entire project will be available upon request by the end of August.

Contract Areas



① FOREST DISTRICT NUMBER

■ COUNTIES NOT INVOLVED

Spray Aircraft Used

Contract 92-1
 2 - Bell 204
 1 - Bell Soloy
 1 - Hughes 500D

Contract 92-4
 2 - Bell 206

Contract 92-2
 3 - Turbo Thrush

Contract 92-5
 1 - Air Tractor AT-401
 1 - Thrush 600 S2R

Contract 92-3
 1 - Bell 206
 1 - Bell Soloy
 1 - Hughes 500D

Contract 92-6
 2 - Bell 204
 1 - Bell 206

Acres Treated by Ownership and Insecticide

Ownership	Bt		DFB		Total	
	Acres	Blocks	Acres	Blocks	Acres	Blocks
Private	91,074	1,534	45	2	91,119	1,536
State Forest	16,814	39	81,505	143	98,319	182
State Park	7,896	59	3,203	16	11,099	75
Federal	967	21	0	0	967	21
Other	2,889	22	368	4	3,257	26
Totals	119,640	1,675	85,121	165	204,761	1,840

DER Contract Costs - 1992 Gypsy Moth Suppression Project

Contractor	Contract	Bid Price		Acres Treated		Extra*		Actual Cost/Acre		Contract Cost	
		Bt	DFB	Bt	DFB	Bt	DFB	Bt	DFB	Bt	DFB
AgRotors, Inc. Gettysburg, PA	92-1	\$ 9.42 (24 BIU) 12.02 (36 BIU)	-	60,550 (30,507-24) (30,043-36)	-	317 (167-24) (150-36)	-	\$10.77 (9.47-24) (12.08-36)	-	\$ 651,868.94 (288,949.08-24) (362,919.86-36)	-
Aero Tech, Inc. Clovis, NM	92-2	-	\$3.82	-	39,378	-	3	-	\$3.82	-	\$150,435.42
AgRotors, Inc.	92-3	10.32 (24 BIU)	6.75	10,789	18,961	154	0	10.47	6.75	112,931.76	127,986.75
AgRotors, Inc.	92-4	10.32 (24 BIU) 13.02 (36 BIU)	-	19,288 (14,993-24) (4,295-36)	-	143 (52-24) (91-36)	-	11.01 (10.36-24) (13.30-36)	-	212,370.12 (155,264.40-24) (57,105.72-36)	-
Tallman Aerial Sprayiny Dauphin, PA	92-5	-	5.03	-	26,782	-	10	-	5.03	-	134,763.76
AgRotors, Inc.	92-6	12.16 (36 BIU)	-	29,013	-	1	-	12.16	-	352,810.24	-
Totals/Averages	All	\$11.06 (9.83-24) (12.15-36)	\$4.85	119,640 (56,289-24) (63,351-36)	85,121	615 (373-24) (242-36)	13	\$11.12 (9.90-24) (12.20-36)	\$4.85	\$1,329,951.00 (557,145.24-24) (772,835.82-36)	\$413,185.93
Total Acres Treated - 204,761											
Average Cost/Acre - \$8.51											

*Resprays and calibration adjustments--expressed as acre equivalents.

VIRGINIA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

1992 SUPPRESSION PROJECTS

I. COOPERATIVE GYPSY MOTH SUPPRESSION PROGRAM

- 111,594 acres aerially treated with Bt. or diflubenzuron in 12 localities.

A. Lot 1 - Rotary wing aircraft

1. Bt Applications - 14,878 Acres

Formulation:	Foray 48b (undiluted)
Dose:	24 BIU's per acre
Application rate:	.5 Gallons per acre
Contractor:	Ag Rotor's, Inc.
Cost:	\$16.28/acre
Aircraft:	2-Bell 204's
Spray system:	Micronaires AU5000 - 8

2. Diflubenzuron - 5,694 Acres

Formulation:	Dimilin 4L
Dose:	.5 oz. A.I. per acre
Application rate:	1 Gallon per acre
Contractor:	Ag Rotor's, Inc.
Cost:	\$14.58/acre
Aircraft:	2-Bell 204's
Spray system:	Micronaires AU5000 - 8

B. Lot 2 - Fixed wing aircraft

1. Bt. Applications - 28,747 Acres

Formulation:	Foray 48B (undiluted)
Dose:	24 BIU's per acre
Application rate:	.5 Gallons per acre
Contractor:	Bob Ruhe Ag Services
Cost:	\$7.25 per acre
Aircraft:	4 - Turbine Thrushes
Spray system:	23, 8006 flat fan, stainless

2. Diflubenzuron - 62,275 Acres

Formulation:	Dimilin 4L
Dose:	.5 oz. A.I. per acre
Application rate:	1 Gallon per acre
Contractor:	Bob Ruhe Ag Services
Cost:	\$5.86 per acre
Aircraft:	4 - Turbine Thrushes
Spray system:	42, 8006 flat fan, stainless

II. APPALACHIAN INTEGRATED PEST MANAGEMENT PROJECT (AIPM)

- 87,171 acres aerially treated with Bt. or diflubenzuron in 10 localities.

A. Fixed wing Aircraft

1. Bt Applications - 47,012 Acres

Formulation:	Foray 48B (undiluted)
Dose:	24 BIU's per acre
Application rate:	.5 Gallons per acre
Contractor:	Bob Ruhe Ag Services
Cost:	\$7.15 per acre
Aircraft:	4 - turbine thrushes
Spray system:	23, 8006 flat fan, stainless

2. Diflubenzuron - 40,159 Acres

Formulation:	Dimilin 4L
Dose:	.5 oz. A.I. per acre
Application rate:	1 gallon per acre
Contractor:	Bob Ruhe Ag Services
Cost:	\$5.65 per acre
Aircraft:	4 - Turbine thrushes
Spray system:	42, 8006 flat fan, stainless

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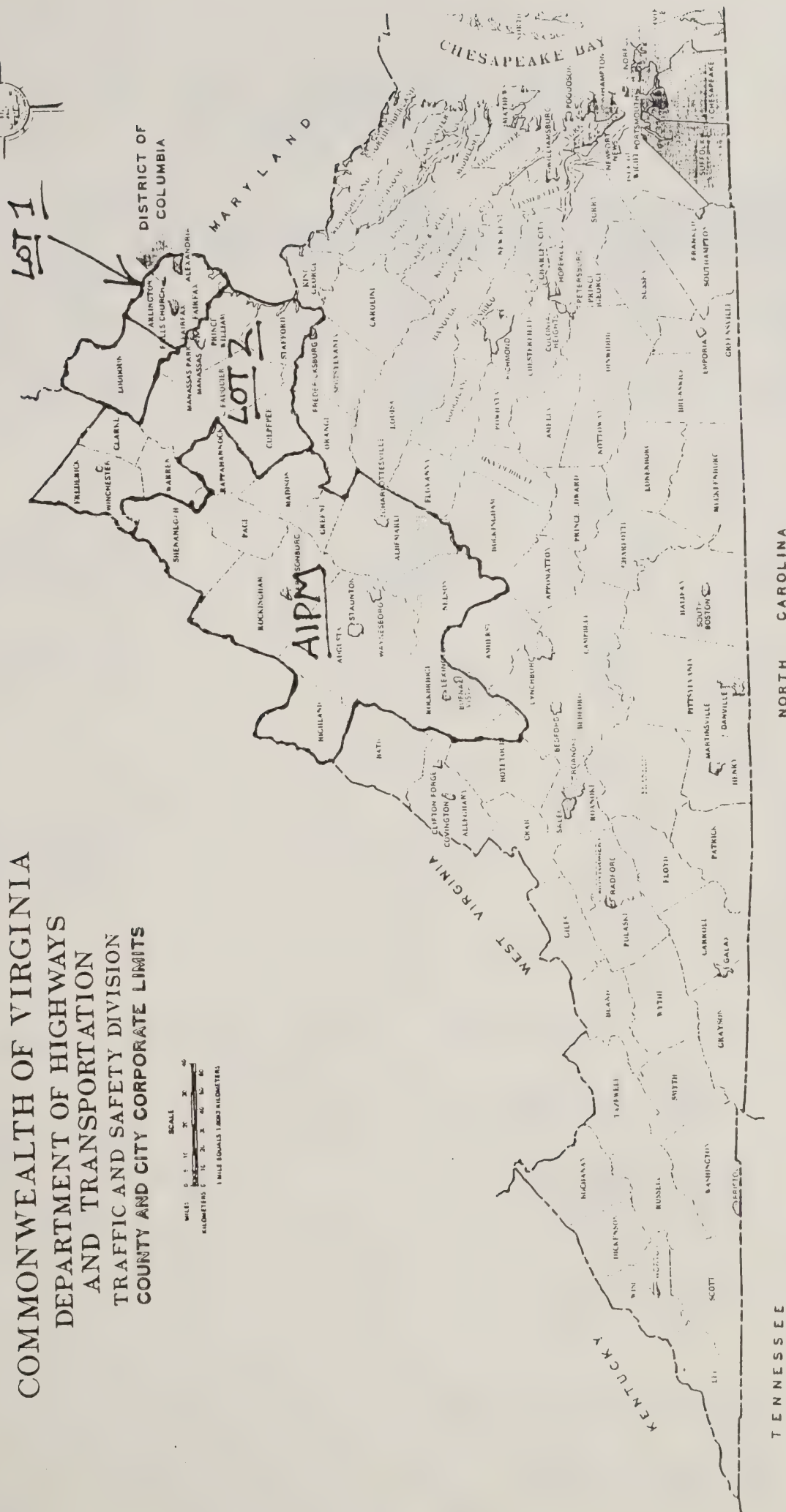
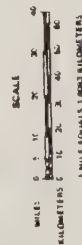


Figure #1.
1992 VIRGINIA GYPSY MOTH SUPPRESSION
AREA.

West Virginia Department of Agriculture
Plant Industries Division
1992 Gypsy Moth Suppression
Acres Treated as of May 27, 1992

CSCL - Eastern Panhandle	<u>Dimilin</u>	<u>Bt</u>	<u>Total</u>
Jefferson County	2,345	0	2,345
Berkeley County	2,500	160	2,660
Morgan County	2,697	3,248	5,945
Hampshire County	12,831	0	12,831
Mineral County	1,410	0	1,410
Grant County-CSCL	440	0	440
Hardy County-CSCL	4,293	0	4,293
	<u>26,516</u>	<u>3,408</u>	<u>29,924</u>

AIPM-CSCL	<u>Dimilin</u>	<u>Bt</u>	<u>Total</u>
Grant County-AIPM	5,196	50	5,246
Hardy County-AIPM	8,080	3,712	11,792
	<u>13,276</u>	<u>3,762</u>	<u>17,038</u>

AIPM-CSCL (Preston Co.)	<u>Dimilin</u>	<u>Bt</u>	<u>Total</u>
	2,370	0	2,370

AIPM 100%	<u>Dimilin</u>	<u>Bt</u>	<u>Total</u>
Monongalia County	520	1,422	1,942
Randolph County	0	445	445
Pendleton County	1,900	23,536	25,436
Summers County	0	432	432
	<u>2,420</u>	<u>25,835</u>	<u>28,255</u>
TOTAL	44,582	33,005	77,587

Monongahela National Forest (AIPM)	WVDA (AIPM)
Total	
Bt 9,977 acres	Monroe County
Gypchek 470 acres	Pheromone Flakes 400 acres
Pheromone Flakes 450 acres	
	Mercer County
Jefferson National Forest	Pheromone Flakes
Monroe County	Bluefield Quad 850 acres
Pheromone Flakes 97 acres	Athens Quad 150 acres
	1,800 acres
	Princeton Quad 250 acres
	Oakvale Quad 200 acres
	3,250 acres

WVDA Regulatory Program

Hancock County Bt	1,464 acres
Brooke County Bt	560 acres
	<u>2,024 acres</u>

WISCONSIN Gypsy Moth Program

Steve Krause

Gypsy Moth Program Coordinator/Entomologist

Wisconsin Department of Agriculture, Trade and Consumer Protection

801 W. Badger Road, Madison, WI 53708, 608/266-7136

History

Gypsy moth populations have been delimited and successfully eradicated on six occasions in Wisconsin's 22 year-old gypsy moth program. The State has used mass trapping, B.t.k., carbaryl, disparlure, and Gypchek in projects that required 3-6 years of treatments to achieve eradication. Since 1990 low-level populations have been uncovered in eastern counties bordering Lake Michigan that are now the subject of aggressive eradication efforts.

In 1991, approximately 6000 acres in three counties were treated with B.t.k. (2 neat applications, 24 B.I.U). Populations in treatment areas were reduced up to 85%, and moths/trap declined statewide from 0.575 in 1990 to 0.498 in 1991. However, delimitation trapping illustrated a broader infestation than previously realized.

In 1992, a total 43,765 acres were sprayed 3 times with B.t.k. (24 B.I.U). Duflo Spray-Chemical, Inc. was contracted, and used 4 twin-engine Piper Aztecs to complete the five county project between May 19 and June 8.

An unprecedented mass trapping effort using 9 traps per square mile on approximately 3600 square miles of State natural areas is being coordinated by the WI Department of Natural Resources.

1992 Program Components

1. 43,765 acres treated with 3 applications of B.t.k.
2. 3,600 acres mass trapped
3. 58,000+ traps used in detection/delimitation/eradication
4. Gypsy Moth Advisory Committee to develop long-term funding strategy
5. Gypsy Moth Working Group fall meeting recommends treatment and survey protocol

Harry Yates

Southeastern Forest Experiment Station

University of Georgia

Evaluations are continuing of southern forest trees as potential gypsy moth hosts. This year, Dr. Berisford's laboratory has evaluated two hardwood hosts (sweetgum and water oak) growing in pure loblolly pine stands. Both codominant and under story trees supported high survival and rapid growth of gypsy moth larvae. These data suggest that stands classified as pure pine may support some gypsy moths on small understory hardwoods plus occasional codominants. The potential threat to pine is still unknown at this time.

There is a need for some continued funding for researchers in the South for two reasons: (1) The vegetation and climate are very different and native natural enemies may also be different. (2) We need at least a few people in the South with some "hands-on" experience with the moth. These should be people who are familiar with southern vegetation, forestry practices, climate, etc. These people will be useful resources for planning control and/or research projects. It appears that much of the dogma relative to the moth in the North may not be applicable in the South. We need to develop our own data base and make decisions based on information from the region.

North Carolina State University

Dr. Fred Hain with North Carolina State University is in the second year of a study on the influence of the white-footed mouse on gypsy moth populations as they invade the South. Study plots are in North Carolina south of the general leading edge of the infestation. Research is funded by the Southeastern Forest Experiment Station, USFS.

Gypsy Moth Infestation - Eradication Project

The first gypsy moth adult was trapped four years ago in White County, Georgia near the town of Helen. During 1991 egg masses were found over several thousand acres. A cooperative control project was planned for the spring of 1992. Agencies involved included the State of Georgia, Extension Service, University of Georgia, APHIS, USDA, the US Forest Service, and the Georgia Forestry Commission. A 5,200 acre area was sprayed twice with BT. Funding totaling about \$90,000 was shared by the County, Georgia Forestry Commission, USFS and the Southern States Forest Pest Compact. Spraying was timed to coincide with a 10% egg hatch. Good weather prevailed through the entire spray period. As of the first week of August 72 moths have been trapped around the spray area.

Jeff Witcosky

1992 AIPM GYPSY MOTH ACTIVITIES AT THE HARRISONBURG OFFICE OF FPM

Gypsy moth treatment acreage is as follows:

Agency	Dimilin	Bt	Gypchek	Sterile Eggs	Pheromone Flakes
Blue Ridge Parkway	78	1,077	149	0	1,496
George Washington NF	60	2,130	0	3	0
Jefferson NF	0	0	343	0	2,804
Monongahela NF	--	--	470	--	--
Shenandoah National Park	1,340	75	0	0	0
Virginia S&P	--	--	1,090	--	626
West Virginia S&P	--	--	--	--	369
Totals:	1,478	3,282	2,052	3	5,295

Highlights:

- (1) First operational Gypchek project organized and conducted by Dee Dee Sellers for AIPM. Treatments were determined to be successful in protecting foliage. Post-treatment egg mass surveys still need to be completed.
- (2) Combined treatment using gypsy moth specific tactics to slow the spread of gypsy moth: Gypchek and mating disruption using pheromone flakes. The AIPM project included the Blue Ridge Parkway, the Glenwood RD of the Jefferson NF, and private lands in the state of Virginia. The treatments were conducted by Donna Leonard (Asheville--FPM) and Dee Dee Sellers.
- (3) Bt project looking at maximum dosages of Thuricide 64LV against late instar gypsy moth larvae. Treatments also examined whether a small droplet VMD (approximately 120 microns) would be more effective than a larger droplet VMD (approximately 250 microns).
- (4) For the past two years we have been working with Dr. Ann Hajek, of Boyce Thompson Institute, and Dr. Joe Elkinton, of the University of Massachusetts, examining methods for the release of the gypsy moth-killing fungus, Entomophaga maimaiga into gypsy moth populations in Virginia and West Virginia. Estimates of spread obtained from our 1991 release sites suggested that the fungus may spread up to 350 meters in one season. The fungus was determined to be killing caterpillars at these 1991 sites during the 1992 field season, indicating that it was established at the release sites. The fungus appears to capable of developing to epidemic levels across a broad range of population densities; it is particularly noteworthy that E. maimaiga can build to epidemic levels in relatively low (non-damaging) populations. In 1992, the fungus spread across the entire acreage of the George Washington National Forest infested with gypsy moth. We observed dramatic E. maimaiga-induced declines in gypsy moth populations across the GWNF (male moth captures and egg masses) and a significant

reduction in gypsy moth defoliation. Isolated populations ahead of the infested front of gypsy moth, populations in the defoliated area, and populations in collapsed areas behind the defoliated area were severely impacted by E. maimaiga. The fungus appears to be capable of building to epidemic levels in relatively low (non-defoliating) populations of gypsy moth, thereby delaying or disrupting the typical population outbreak cycle; it also appears to be disrupting the natural spread of gypsy moth. E. maimaiga will change fundamentally the population dynamics of the gypsy moth.

Jeff Witcosky

John Wenz

NATIONAL STEERING COMMITTEE
FOR
MANAGEMENT OF WESTERN DEFOLIATORS

R5-Pacific Southwest Region Report
August 20-21, 1992

John M. Wenz

Note p. 2
on gypsy moth

Current Status

- 1) Modoc budworm. Defoliation of true fir (white fir, Abies concolor, and red fir, A. magnifica) by the Modoc budworm, Choristoneura viridis (?), was detected in June 1992, over approximately 105,000 acres on the Modoc National Forest in northeastern California. High population levels and heavy defoliation have been observed in the Mill Creek, Benton Meadows, and Halls Meadow areas in the north Warner Mountains and in the Dry Creek-Deep Creek area in the south Warners. Low populations were found over about 50,000 acres, medium populations over 30,000 acres, and high populations on 25,000 acres. High activity levels are confined to overstocked, multi-storied, true fir stands at higher elevations. Defoliation in these stands is evident on trees at all canopy levels, dominant to understory. In lower elevation mixed conifer stands (white fir, Jeffrey pine, Pinus jeffreyi, and ponderosa pine, P. ponderosa), defoliation is minimal and concentrated on understory fir up to 20 feet in height. In intermediate elevation mixed conifer stands composed of true fir and lodgepole pine (P. lambertiana), the sugar pine tortrix, Choristoneura lambertiana, is defoliating the lodgepole pine. Sugar pine tortrix activity is particularly evident over about 20,000 acres in the Lassen Creek-Benton Meadows area. Budworm defoliation in these stands is generally confined to understory, suppressed, fir. The Modoc National Forest is currently analyzing the situation and has expressed interest in silvicultural treatment alternatives.
- 2) Gypsy Moth. As of July 27, 1992, seven gypsy moths had been trapped in California. Single catches have been reported by the following Counties (Cities): Los Angeles (Lancaster), Sacramento, San Diego (Carlsbad), San Francisco, San Bernardino (Yucaipa), Santa Barbara (Lompoc), and Stanislaus (Turlock). all single catches
- 3) Other Defoliators: Scattered defoliation of oaks by the fruit tree leafroller, Archips argyrospilus, was reported from several locations in the San Bernardino Mountains (San Bernardino National Forest) in southern California. Moderate to heavy feeding by the black pineleaf scale, Nuculaspis californica, on ponderosa and sugar pine was reported from several locations in central and northern California. There is particular concern that black pineleaf scale feeding damage, in conjunction with extended drought stress, will predispose white pine blister rust resistant, and resistant-candidate (untested) sugar pines, to bark beetle attack. In

addition, defoliation by the white fir sawfly, Neodiprion sp., was noted in several areas in central and northeastern California. The heaviest sawfly defoliation is to understory fir in mid- to low-elevation mixed conifer stands.

Suppression and Eradication

With the exception of an individual tree treatment for black pineleaf scale, there were no forest defoliator suppression or eradication projects in R5 in 1992. One rust resistant sugar pine was sprayed with carbaryl to control the black pineleaf scale on the Pacific District, Eldorado National Forest. Post-treatment evaluation indicates good control in terms of scale mortality and at last check, the sugar pine was still extant.

Appendix B

Technology Development Needs
Letter



Reply To: 3400

Date: September 2, 1992

Subject: Technology Development Needs (Gypsy Moth)

To: Director, FPM
Thru: Assistant Director, PUM&C

The National Steering Committee for Management of Gypsy Moth and Eastern Defoliators met at Albuquerque, NM, on August 18-19. The committee reviewed 1991 needs, recommendations, and progress. The revised technology needs and priorities are as follows:

Priority 1

Conduct studies in the West and South on impact of Bacillus thuringiensis (Bt) insecticides on non-target indicator species.

Priority 2

Identify another suitable insecticide to replace DDVP for use in the milk carton control trap. (DDVP is not safe to handle.)

Priority 3

- .Improve methodology for monitoring, detecting, and predicting low and high populations of gypsy moth populations.
- .Develop plan for conducting studies on use of fungus to control gypsy moth. Studies are needed to address questions related to effectiveness, long term results and impact. (This initial effort may require funds for cooperators and/or contractors.)

Priority 4

Evaluate feasibility and/or conduct a pheromone flake study against low populations of gypsy moth in the West.

Priority 5

- .Conduct field studies to evaluate and possibly ascertain appropriate BIU's of Bt per acre and volume to treatment timing, number of treatments as related to population levels, and forest canopy density. (This obviously is a very complex challenge consisting of several sub-problems.)

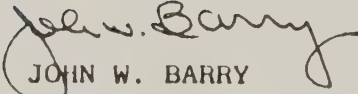


.Validate gypsy moth phenology model in the West and East.

.Develop methodology for mass balance and total accountancy of pesticides applied by aerial and ground spray equipment.

Priority 6

Pilot test new Bt formulations in the East and viruses in the West.


JOHN W. BARRY
Chairperson

cc: Steering Committee
Mel Weiss, WO/FPM

Appendix C

Asian Gypsy Moth

FOREST SERVICE
BRIEFING PAPER

Topic: Asian gypsy moth

Issue: Asian gypsy moth a concern in Pacific Northwest

Background:

- o The Asian Gypsy Moth Eradication Project in the Pacific Northwest included 116,800 acres around Tacoma Washington, and 8,000 acres in North Portland, Oregon. Each area was sprayed three times, seven to ten days apart, with the biological insecticide, *Bacillus thuringiensis*.
- o Two court chalanges to the program based on potential human health effects were not sustained by Federal District court.
- o High density trapping is being conducted in both states in areas sprayed and in other potential introduction sites.
- o By 8/27/92, recurring trap checking has found 425 gypsy moths trapped in Washington. Only one was found in the treatment area and none have been identified as Asian Gypsy Moth. Trap checking in Oregon has found 40 moths. None in treated area and none identified as Asian.
- o Each sample moth is being identified by DNA analysis. This is the only scientifically supportable identification technique available at this time. The procedure is time-consuming and costly. Additional techniques are being examined.
- o Preliminary contingency plans are being developed should Asian Gypsy Moth be trapped this year in Oregon or Washington.
- o APHIS plans to prepare an EA tiered to the 1985 Gypsy Moth EIS should any actions be needed in 1993. APHIS will concurrently prepare a Regional EIS should any actions be needed in Oregon or Washington in 1994. It is anticipated that the new National Gypsy Moth EIS will be completed in time for any needed actions in 1995.
- o The Asian gypsy moth is a serious threat because unlike the gypsy moth already in this country the Asian adult female can fly.
- o Agriculture Canada has an aggressive program of ship inspection and eradication efforts. An area in Vancouver, British Columbia was treated with an eradivative spray this year. To date, no moth catches in Canada have been identified as Asian Gypsy Moth.
- o Responsibility for regulatory action against the Asian gypsy moth in the U.S. is the responsibility of USDA APHIS. The USDA Forest Service is supporting APHIS by increasing research on identification and survey methods.
- o The Washington Department of Agriculture, Oregon State Department of Agriculture, APHIS, and the Forest Service (Pacific Northwest Region) are working together to address the gypsy moth situation in the Pacific Northwest.

MESSAGE DISPLAY FOR FAY L. SHON

To N.GRAYBEAL
To FPM GROUP LEADERS
To D.BRIDGWATER
CC M.OLLIEU

From: Max Ollieu Host: R06C
Postmark: Sep 18,92 11:00 AM Delivered: Sep 18,92 11:00 AM
Status: Previously read
Subject: DISCUSSION WITH GARY SMITH (APHIS)

Message:

FOLLOWING A DISCUSSION ON THE FY 93 BUDGET FOR AGM RELATED EXPENSES,
GARY UPDATED ME ON THE LATEST TRAP COUNTS AND DNA ANALYSIS.

MOTHS TRAPPED

WA	-	451	250-300 WITH DNA DONE	ALL EUROPEAN
OR	-	46		
BC	-	126		
CA	-	8		
ID	-	3		

THE 300 MAY INCLUDE SOME FROM OTHER LOCATIONS, BUT THOSE NEAR THE
TREATMENT SITES WERE ANALYZED FIRST. GARY DOESN'T EXPECT MANY MORE
TO COME IN FROM THE TRAPS BECAUSE OF THE FREQUENT VISITS
TO CHECK THE TRAPS, PARTICULARLY IN WA. THE ADDITIONAL TRAPPING WILL
HELP IDENTIFY AREAS THAT NEED TO BE TREATED FOR THE EUROPEAN FORM.

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